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CIMRON®

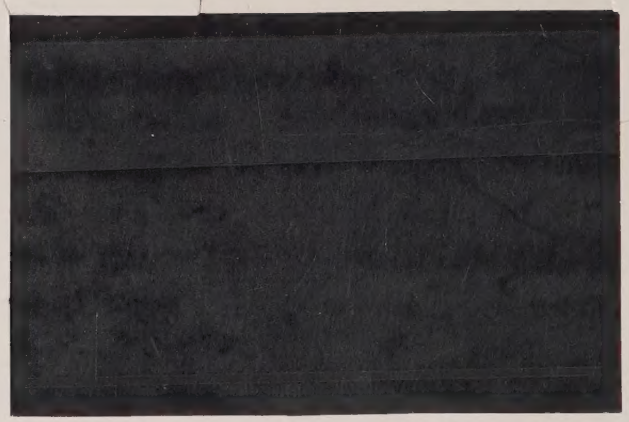
MODEL DMM 50

DIGITAL MULTIMETER

CALIF. INST
714, 279-8620

MP MASTER
MA28084

V.K.I.G LABORATORIES INC.



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Revision D
June, 1976

INSTRUCTION MANUAL

CIMRON®

MODEL DMM 50

DIGITAL MULTIMETER

VIKING LABORATORIES INC.

LIST OF TABLES

TABLE	TITLE	PAGE
3-1	Operating Controls, Indicators, and Connectors	3-2
3-2	Initial Position of DMM Front Panel Switches	3-6
3-3	DMM Readout Versus Actual Ratio Values	3-7
5-1	Remote Programming, Connector Pin Assignments to J1	5-19

LIST OF ILLUSTRATIONS

FIGURE	TITLE	PAGE
3-1	Four-Wire Ohms Measurement	3-8
3-2	DMM - Recorder Interface Connections	3-10
3-3	DMM - Remote Programmer Interface Connections	3-11
5-1	DMM 50 Analog Block Diagram	5-2
5-2	DMM 50 Digital Block Diagram	5-3
5-3	DMM 50 Control Block Diagram	5-4
5-4	Analog Switching Block Diagram	5-6
5-5	DMM 50 Timing Chart	5-8
5-6	DAC Operating Principles	5-12
5-7	Data Output Pin Connections (J2)	5-21

LIST OF DRAWINGS

ASSY REF. DES.	TITLE	PAGE
	5 Digit Digital Multimeter Schematic, 200401	6-2
	Multimeter, Digital 5 Digit, P/N 200400-01	6-3
A1	Board Assembly Optional Accessory, Display, P/N 200445-01	6-46
A2	Data Output/Remote Programming Schematic, 200436	6-60
	Board Assembly, Data Output/Remote Programming, P/N 200435-01, –02	6-61
A3	Digital Board Assembly Schematic, 200441	6-34
	Board Assembly, Digital, P/N 200440-01	6-36
A4	Power Supply Schematic, 200431	6-26
	Board Assembly, Power Supply, P/N 200430-01	6-27
A5	AC/K Ohms Assembly Schematic, 200426	6-50
	Board Assembly, AC/K Ohms, P/N 200425-01, –02, –03	6-51
A6	Analog Board Assembly Schematic, 200421	6-8
	Board Assembly, Analog, P/N 200420-01	6-10

TABLE OF CONTENTS

SECTION		PAGE
I	**INTRODUCTION**	1-1
	GENERAL DESCRIPTION	1-1
	Basic Instrument Capabilities	1-1
	Instrument Capabilities With Accessories	1-1
	Fabrication	1-2
II	**SPECIFICATIONS**	2-1
	GENERAL	2-1
	DC Voltage Measurement	2-2
	DC/DC Ratio	2-4
	AC Voltage Measurement	2-4
	Resistance Measurement	2-6
III	**OPERATING INSTRUCTIONS**	3-1
	OPERATING CONTROLS, INDICATORS, AND CONNECTORS	3-1
	OPERATIONAL CHECKOUT	3-1
	General	3-1
	Preliminary Procedure	3-6
	Checkout Procedure	3-6
	Rate	3-8
	Interface Checkout	3-9
IV	**CALIBRATION PROCEDURES**	4-1
	GENERAL	4-1
	Calibration Procedures	4-1
	Calibration of Basic Instrument	4-1
	AC & Ohm Converter Checkout	4-4
V	**THEORY OF OPERATION**	5-1
	GENERAL	5-1
	Block Diagram Description	5-1
	Analog	5-1
	Digital	5-1
	Control	5-1
	Analog Switches	5-1
	Timing	5-7
	Signal Conditioning	5-10
	Analog Board	5-11
	Buffer Amplifier	5-11
	Reference	5-12
	Ratiometer	5-12
	Digital-to-Analog Converter	5-12

TABLE OF CONTENTS (Cont'd)

SECTION		PAGE
V	THEORY OF OPERATION (Cont'd)	
	Integrator	5-13
	Comparator	5-14
	FET Switching	5-14
	Digital Circuitry	5-14
	Sample Rate Generator	5-14
	Clock and Counter	5-14
	DAC Decoder and Driver	5-15
	Overload	5-16
	Sign	5-16
	Control Circuitry	5-17
	Power Supply	5-17
	Data Output	5-18
	Operation	5-18
	Isolation	5-18
	Programming	5-18
	Data Output	5-18
	Parallel Data Acquisition	5-18
	Overload (Overscale)	5-20
	Ready	5-20
	Serial Character Data Acquisition	5-20
VI	MAINTENANCE	6-1
	General Maintenance	6-1
	Troubleshooting and Repair	6-1
	Preventive Maintenance	6-1
	WARRANTY	

SECTION I
INTRODUCTION

GENERAL DESCRIPTION

The Model DMM50 Digital Multimeter consists of a DC Voltmeter and DC/DC Ratiometer basic instrument and optional accessories. The accessories, available in any combination, are:

1. True RMS Converter
2. AC Converter
3. Ohms Converter
4. Data Output (Isolated)
5. Data Output/Remote Programming (Isolated)

Rack-mounting slides, rear-panel mounted signal input and external reference voltage input connectors, and a 50 hertz line frequency noise rejection feature are available as optional equipment.

BASIC INSTRUMENT CAPABILITIES

The DMM50 uses a combination of successive approximation and three step integration that achieves fast measurement speed with excellent normal mode noise rejection at line-related frequencies.

The basic instrument can measure DC voltages and ±DC/+DC voltage ratios. The input signal can be sampled from one to five times per second from the Front Panel Rate control or up to 20 times per second from the Ext. Trig. input. Instrument functions, sampling rates, input signal filtering, and ranges are selected by means of front panel controls. Ranges can be selected manually or automatically. When in automatic ranging the DMM selects the range which provides maximum resolution of the input signal amplitude.

There is a front panel display of five digits (six digits for up to 20% overrange), a decimal point, and a polarity symbol. In the DC measurement mode, input signal polarity is detected automatically. Front panel lights indicate the function that has been selected.

When the input signal amplitude exceeds the 20% overrange limit of a manually selected range, the instrument displays a 120000 readout with the 0000 portion blinking on and off.

DC Voltage Measurement

The instrument can measure DC voltages from ±00.001 mv to ±1100.00V in five full-scale ranges of 119.999mv and 1.19999, 11.9999, 119.999, and 1100.00V.

Ratio Measurement

The instrument can compare the amplitude of a positive or negative signal input voltage to a positive external reference voltage and display the result as a X10 ratio. There are five ranges of 100mv:10V, 1V:10V, 100V:10V and 1000V:10V. The external reference voltage can be any value from +8V to +11V.

INSTRUMENT CAPABILITIES WITH ACCESSORIES

In addition to its basic capabilities, the DMM50 with optional accessories installed can provide the following:

1. AC Converter – Measure AC voltages from .00001V to 1100.00V rms in four full-scale ranges of 1.19999, 11.9999, 119.999, and 1100.00 over a frequency range of 30 Hz to 100 kHz, provided the signal volt-hertz product does not exceed 2×10^7.

2. Ohms Converter – Measure resistance from .00001 kΩ to 11999.9 kΩ in five full-scale ranges of 1.19999, 11.9999, 119.999, 1199.99, and 11999.9. The four-wire method is used in measuring resistance.

3. Data Output – Provides parallel 8-4-2-1 BCD outputs of DMM function and front panel readout.

Either a Data Ready (Print) command or Busy signal is also provided. All Data Output circuits are buffered, shortcircuit proof, and fully isolated. Logic levels are DTL/TTL compatible. When the Data Output option is installed in the DMM, the associated recorder or computer is enabled to control the DMM sampling rate and data transfer.

4. Data Output/Remote Programming Option – Remote Programming is available only with the Data Output option. The Remote Programming option enables remote control of DMM functions, ranging, filtering, sampling rate and data transfer.

FABRICATION

Case-within-a-case construction is used to ensure maximum input isolation and common mode rejection. The input signal leads are floating and isolated from the case, power line ground, and data output circuitry. Solid state components are used almost exclusively. All calibration controls are made accessible by removing the top cover.

SECTION II

SPECIFICATIONS

GENERAL

POWER REQUIREMENTS	105-125V/210-250V, 50-440 Hz 0.5A at 115V 0.25A at 230V
WARMUP TIME	30 minutes
TEMPERATURE	
OPERATING	0°C to +55°C
STORAGE	–40°C to +75°C
HUMIDITY	Proper operation up to 80% RH, noncondensing at 25°C.
ALTITUDE	
OPERATING	10,000 feet (3048 meters)
STORAGE	50,000 feet (15,240 meters)
SHOCK AND VIBRATION	The DMM 50 can withstand normal handling and shipping shock and vibration
DIMENSIONS	Height: 3.5" (8.89 cm) Width: 17.0" (43.18 cm) Depth: 17.5" (44.45 cm)
WEIGHT	
WITH ALL OPTIONS	20 lb. (9.072 kg)

NOTE

Full Scale (FS) is defined as 120% of range for all ranges except the 1000V AC and 1000V DC ranges.

Full Scale is defined as 110% of the 1000V AC and 1000V DC ranges.

CAUTION

To avoid damaging the DMM the following input signal voltage values must not be exceeded:

DC Measurement	1100 VDC
AC Measurement	1100V rms (1500V DC or peak AC)
Resistance Measurement	220V rms
LO to GUARD	150V
GUARD to GROUND	1000V DC or peak AC

NOTE

Accuracy specifications apply only when the DMM has been calibrated using equipment listed in Section IV Calibration Instructions.

DC VOLTAGE MEASUREMENT

RANGES	100 mv, 1V, 10V, 100V, 1000V
OVERRANGE	20% (10% on 1000V range)
RESOLUTION	0.001% of range (1μV on 100 mv range)
ACCURACY	
24 HOURS	Reference Conditions: 23°C ±1°C
10, 100, 1000V Ranges	±(0.002% RDG +0.0008% FS)
1V Range	±(0.003% RDG +0.0008% FS)
100 mv Range	±(0.002% RDG +0.005% FS)
90 DAYS	Reference Conditions: 20°C to 30°C
10, 100, 1000V Ranges	±(0.003% RDG +0.0008% FS)
1V Range	±(0.004% RDG +0.0008% FS)
100 mv Range	±(0.003% RDG +0.005% FS)

6 MONTHS	Reference Conditions: 20°C to 30°C
10, 100, 1000V Ranges	±(0.003% RDG +0.0008% FS)
1V Range	±(0.005% RDG +0.0008% FS)
100 mv Range	±(0.004% RDG +0.005% FS)
1 YEAR	Reference Conditions: 20°C to 30°C
10, 100, 1000V Ranges	±(0.004% RDG +0.0008% FS)
1V Range	±(0.005% RDG +0.0008% FS)
100 mv Range	±(0.006% RDG +0.005% FS)
TEMPERATURE STABILITY	
10V Range	±(0.0005% RDG +0.0001% FS)/°C
1, 10, 100, 1000V Ranges	±(0.0007% RDG +0.0002% FS)/°C
100 mv Range	±(0.001% RDG +0.0005% FS)/°C
INPUT RESISTANCE	
100 mv + 1V Range	1000 MΩ
10V Range	10,000 MΩ
100, 1000V Ranges	10 MΩ
OFFSET CURRENT	Less than 20 picoamps (23°C);

	UNFILTERED	FILTERED
RESPONSE TIME (Settling time not included)		
FULL SCALE STEP RESPONSE	57 msec	57 msec
POLARITY CHANGE	155 msec	660 msec
ONE RANGE CHANGE	210 msec	710 msec
SETTLING TIME		
.1, 1, 10V Ranges	"0"	650 msec
100, 1000V Ranges	25 msec	650 msec

COMMON MODE REJECTION	1 kΩ Imbalance
DC	> 140 dB
AC (60 Hz and above)	> 120 dB
NORMAL MODE REJECTION	60 Hz or 50 Hz with 50 Hz line option
FILTER OUT	60 dB
FILTER IN	100 dB

DC/DC RATIO

EXTERNAL REFERENCE VOLTAGE +8 to +10.0V

RANGES 100 mv: 10V, 1V:10V, 10V:10V, 100V:10V, 1000V:10V

OVERRANGE 20% (10% on 1000V:10V)

ACCURACY

24 HOURS	Reference Conditions: 23°C ±1°C
10, 100, 1000V Ranges	$\pm(0.002\%\ \text{RDG} + 0.0008\%\ \text{FS} \times \frac{10\text{V}}{\text{Ref. Volts}})$
1V Range	$\pm(0.003\%\ \text{RDG} + 0.0008\%\ \text{FS} \times \frac{10\text{V}}{\text{Ref. Volts}})$
100 mv Range	$\pm(0.002\%\ \text{RDG} + 0.005\%\ \text{FS} \times \frac{10\text{V}}{\text{Ref. Volts}})$
90 DAYS	Reference Conditions: 20°C ±30°C
10, 100, 1000V Ranges	$\pm(0.003\%\ \text{RDG} + 0.0008\%\ \text{FS} \times \frac{10\text{V}}{\text{Ref. Volts}})$
1V Range	$\pm(0.004\%\ \text{RDG} + 0.0008\%\ \text{FS} \times \frac{10\text{V}}{\text{Ref. Volts}})$
100 mv Range	$\pm(0.003\%\ \text{RDG} + 0.005\%\ \text{FS} \times \frac{10\text{V}}{\text{Ref. Volts}})$
6 MONTHS	Reference Conditions: 20°C to 30°C
10, 100, 1000V Ranges	$\pm(0.004\%\ \text{RDG} + 0.0008\%\ \text{FS} \times \frac{10\text{V}}{\text{Ref. Volts}})$
1V Range	$\pm(0.005\%\ \text{RDG} + 0.0008\%\ \text{FS} \times \frac{10\text{V}}{\text{Ref. Volts}})$
100 mv Range	$\pm(0.004\%\ \text{RDG} + 0.005\%\ \text{FS} \times \frac{10\text{V}}{\text{Ref. Volts}})$
1 YEAR	Reference Conditions: 20°C to 30°C
10, 100, 1000V Ranges	$\pm(0.004\%\ \text{RDG} + 0.0008\%\ \text{FS} \times \frac{10\text{V}}{\text{Ref. Volts}})$
1V Range	$\pm(0.005\%\ \text{RDG} + 0.0008\%\ \text{FS} \times \frac{10\text{V}}{\text{Ref. Volts}})$
100 mv Range	$\pm(0.006\%\ \text{RDG} + 0.005\%\ \text{FS} \times \frac{10\text{V}}{\text{Ref. Volts}})$

TEMPERATURE STABILITY

10V Range	$\pm(0.0005\%\ \text{RDG} + 0.0001\%\ \text{FS} \times \frac{10\text{V}}{\text{Ref. Volts}})/°\text{C}$
1, 100, 1000V Ranges	$\pm(0.0007\%\ \text{RDG} + 0.0002\%\ \text{FS} \times \frac{10\text{V}}{\text{Ref. Volts}})/°\text{C}$
100 mv Range	$\pm(0.001\%\ \text{RDG} + 0.0005\%\ \text{FS} \times \frac{10\text{V}}{\text{Ref. Volts}})/°\text{C}$

REFERENCE INPUT RESISTANCE 1000 MΩ

SIGNAL INPUT RESISTANCE Same as DC Voltage Measurement

RESPONSE Same as DC Voltage Measurement

COMMON MODE REJECTION Same as DC Voltage Measurement

NORMAL MODE REJECTION Same as DC Voltage Measurement

AC VOLTAGE MEASUREMENT

RANGES 1V, 10V, 100V, 1000V

OVERRANGE 20% (10% on 1000V range)

RESOLUTION 0.001% of range
(10μV on 1V range)

CAUTION

To avoid damaging the DMM, the signal input volt-hertz product must not exceed 2×10^7.

ACCURACY

24 HOURS

Reference Conditions: 23°C ±1°C

	INPUT VOLTAGE <500V	INPUT VOLTAGE >500V
10 Hz – 30 Hz	±(0.2% RDG +0.1% FS)	±(0.2% RDG +0.1% FS)
30 Hz – 50 Hz	±(0.1% RDG +0.02% FS)	±(0.1% RDG +0.02% FS)
50 Hz – 20 KHz	±(0.05% RDG +0.02% FS)	±(0.1% RDG +0.02% FS)
20 KHz – 50 KHz	±(0.05% RDG +0.025% FS)	±(0.15% RDG +0.02% FS)
50 KHz – 100 KHz	±(0.2% RDG +0.08% FS)	Not applicable

90 DAYS	Reference Conditons: 20°C to 30°C	
10 Hz – 30 Hz	±(0.3% RDG +0.1% FS)	±(0.3% RDG +0.1% FS)
30 Hz – 50 Hz	±(0.15% RDG +0.02% FS)	±(0.15% RDG +0.02% FS)
50 Hz – 20 KHz	±(0.07% RDG +0.02% FS)	±(0.1% RDG +0.02% FS)
20 KHz – 50 KHz	±(0.075% RDG +0.025% FS)	±(0.2% RDG +0.02% FS)
50 KHz – 100 KHz	±(0.27% RDG +0.08% FS)	Not applicable
6 MONTHS	Reference Conditions: 20°C to 30°C	
10 Hz – 30 Hz	±(0.4% RDG +0.1% FS)	±(0.4% RDG +0.1% FS)
30 Hz – 50 Hz	±(0.2% RDG +0.02% FS)	±(0.2% RDG +0.02% FS)
50 Hz – 20 KHz	±(0.1% RDG +0.02% FS)	±(0.15% RDG +0.02% FS)
20 KHz – 50 KHz	±(0.1% RDG +0.025% FS)	±(0.3% RDG +0.02% FS)
50 KHz – 100 KHz	±(0.35% RDG +0.08%)	Not applicable
1 YEAR	Reference Conditions: 20°C to 30°C	
10 Hz – 30 Hz	±(0.5% RDG +0.1% FS)	±(0.5% RDG +0.1% FS)
30 Hz – 50 Hz	±(0.22% RDG +0.02% FS)	±(0.22% RDG +0.02% FS)
50 Hz – 20 KHz	±(0.13% RDG +0.02% FS)	±(0.2% RDG +0.02% FS)
20 KHz – 50 KHz	±(0.13% RDG +0.025% FS)	±(0.3% RDG +0.02% FS)
50 KHz – 100 KHz	±(0.43% RDG +0.08% FS)	Not applicable

TEMPERATURE STABILITY	0°C to 55°C ±(0.002% RDG +0.001% FS)/°C
INPUT IMPEDANCE	1 MΩ shunted by <50 pF (<100 pF with optional rear panel input connectors)

RESPONSE TIME (Settling time not included	UNFILTERED	FILTERED
FULL SCALE	57 msec	57 msec
ONE RANGE CHANGE	710 msec	710 msec
SETTLING TIME (to 0.1% of final value)	500 msec	650 msec

COMMON MODE REJECTION	100Ω Unbalance
DC to 60 Hz	100 dB

RESISTANCE MEASUREMENT

RANGE, FULL SCALE (FS) INCLUDING OVERRANGE	CURRENT THRU Rx	RESOLUTION
100 Ω	1 mA	1 mΩ
1 KΩ	1 mA	10 mΩ
10 KΩ	1 mA	100 mΩ
100 KΩ	100 μA	1 Ω
1,000 KΩ	10 μA	10 Ω
10,000 KΩ	1 μA	100 Ω

POWER DISSIPATION IN Rx

<1.2 mW maximum

ACCURACY

24 HOURS	Reference Conditions: 23°C ±1°C
100Ω Range	±(0.01% RDG +0.0016% FS)
1, 10, 100, 1000K Ranges	±(0.003% RDG +0.0008% FS)
10,000K Range	±(0.01% RDG +0.0008% FS)
90 DAYS	Reference Conditions: 20°C to 30°C
100Ω Range	±(0.013% RDG +0.0016% FS)
1, 10, 100, 1000K Ranges	±(0.006% RDG +0.0008% FS)
10,000K Range	±(0.02% RDG +0.0016% FS)
6 MONTHS	Reference Conditions: 20°C to 30°C
100Ω Range	±(0.016% RDG +0.0016% FS)
1, 10, 100, 1000K Ranges	±(0.007% RDG +0.0008% FS)
10,000K Range	±(0.035% RDG +0.0016% FS)
1 YEAR	Reference Conditions: 20°C to 30°C
100Ω Range	±(0.02% RDG +0.0016% FS)
1, 10, 100, 1000K Ranges	±(0.01% RDG +0.0008% FS)
10,000K Ranges	±(0.04% RDG +0.0016% FS)

TEMPERATURE STABILITY

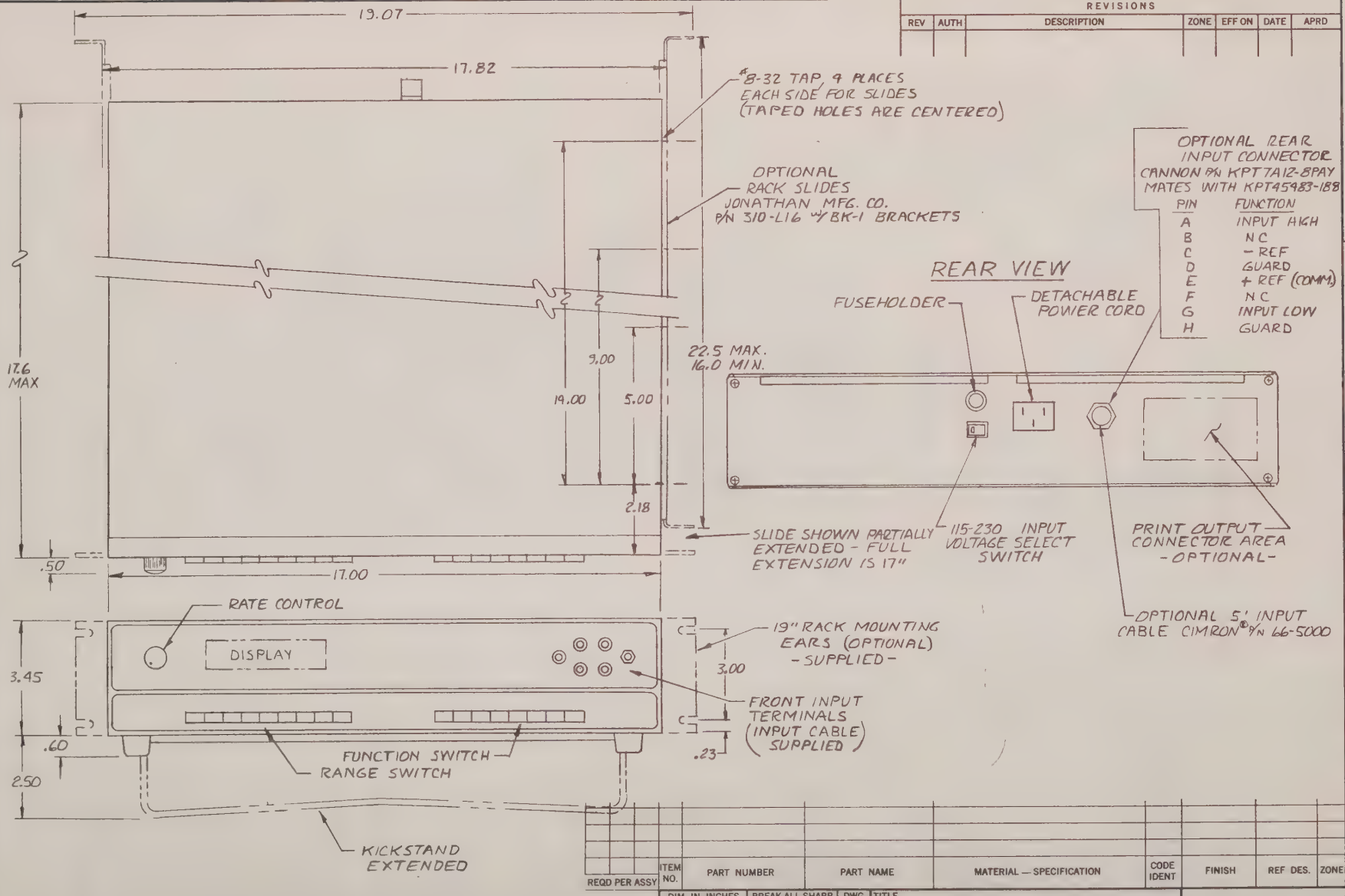
100.000Ω	0°C to 55°C
1, 10, 100, 1000kΩ Ranges	±(0.001% RDG +0.0005% FS)/°C
10,000kΩ Ranges	±(0.0005% RDG +0.0002% FS)/°C
	±(0.007% RDG +0.0003% FS)/°C

RESPONSE TIME	UNFILTERED	FILTERED
All Ranges	57 msec	57 msec
One Range Change	210 msec	710 msec

SETTLING TIME		
.1, 1, 10, 100, 1000kΩ Ranges	"0"	650 msec
10,000kΩ Range	500 msec	1.2 sec

OVERLOAD PROTECTION 220V rms

MEASUREMENT METHOD Modified 4-wire



REVISIONS

REV	AUTH	DESCRIPTION	ZONE	EFF ON	DATE	APRD

ITEM NO.	PART NUMBER	PART NAME	MATERIAL — SPECIFICATION	CODE IDENT	FINISH	REF DES.	ZONE

REQD PER ASSY

DIM IN INCHES
TOLERANCES
.XXX = .010
.XX = .03
X° = 30'

BREAK ALL SHARP CORNERS & EDGES
MACH SURFACES ✓

DWG SIZE C

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TITLE
OUTLINE DRAWING
DIGITAL MULTIMETER

MODEL DMM 50

RELEASE

CHECKER

DESIGN

PURCHASING

PROJ ENGR

CALIFORNIA INSTRUMENTS CORP.
SAN DIEGO, CALIFORNIA

CONTRACT NO. —

CODE IDENT 16067

DWG NO. C200852

REV B

C200852 B

SECTION III

OPERATING INSTRUCTIONS

OPERATING CONTROLS, INDICATORS, AND CONNECTORS

Instrument operating controls, indicators, and connectors are located on the front and rear panels. Table 3-1 lists the operating controls, indicators and connectors and describes the function of each. Schematic designators are as shown on the schematic diagrams.

OPERATIONAL CHECKOUT

NOTE

The liability of Cimron under the warranty is negated if the DMM is improperly repaired. If trouble is experienced during the operational checkout refer to the warranty instructions before attempting repair.

GENERAL

The operational checkout is intended as a preliminary test of DMM operation. Because of specification tolerances, the actual DMM front panel numerical display may often differ from the exact value expressed in the checkout procedure.

The checkout procedures assume that all optional accessories are included in the instrument. Omit test equipment requirements and procedural steps that apply to optional capabilities not included in a particular DMM.

Table 3-1. Operating Controls, Indicators, and Connectors

CONTROL, INDICATOR OR CONNECTOR	POSITION OR CONDITION	FUNCTION
FRONT PANEL		
POWER-RATE (Switch–Potentiometer S1-R1)	Variable	When in OFF position line power is disconnected from DMM. As control is rotated clockwise power is applied to DMM and sampling rate is increased from one-per-second to approximately five-per-second in the full clockwise position.
+ or – (Indicator A1DS1)	Lighted	Indicates input signal polarity in Millivolt and DC measurement functions.
Numerals (Indicators A1DS1-A1DS3)	XXXXXX	Indicates amplitude of input signal, state of each Decade, and Data Output circuit configuration. The most significant digit window is lighted only when the DMM is in an overrange or out-of-range condition. When the DMM is in a manual range and the signal input amplitude exceeds the over-range limits, the numerical readout is 120000, with the 0000 portion blinking on and off.
Decimal (Indicators A1DS1-A1DS3)		NOTE: For conversion of decimal point positions in ratio function refer to Table 3.3.
	XXXXXX	Overrange or out-of-range.
	.XXXXX	1V DC or AC, or 1 kΩ range.
	X.XXXX	10V DC or AC, or 10 kΩ range.
	XX.XXX	100 mV, 100V DC or AC, 100Ω, or 100 kΩ range.
	XXX.XX	1000V DC or AC, or 1000 kΩ range.
	XXXX.X	10,000 kΩ range.
HI (Connector J1) and LO (Connector J2) in parallel with rear panel HI and LO connectors if installed.		Connects signal input voltage to AC/KΩ board, if installed, thence to Analog board. If no AC option, input is connected directly to Analog board.

Table 3-1. Operating Controls, Indicators, and Connectors (Cont.)

CONTROL, INDICATOR OR CONNECTOR	POSITION OR CONDITION	FUNCTION
FRONT PANEL		
+ (Connector J3) and −(Connector J4). In parallel with rear panel + and − connectors if installed.		In ratio function connects external reference voltage to AC/KΩ board, if installed thence to Analog board. If no AC/KΩ option, input is connected directly to Analog board.
GUARD (Connector J5) in parallel with rear panel GUARD connector if installed.		When connected to signal input source, terminates guard shield at signal source.
⏚ (Lug and Banana Jack J6)		Enables connection of external source to DMM power line ground.
Range Switches (Pushbutton Switch A3S1) All switch sections are interlocked. Depressing one section releases any other depressed section.		NOTE: The .1, 10K, or REM switch is disabled if the associated AC Measurement, Resistance Measurement, or Remote Programming option is not installed in the DMM. If the DMM is in any function other than DC or EXT REF, when the .1 switch is depressed the DMM automatically shifts to the 1 range.
.1	Depressed	Sets DMM to .01:1 ratio, 100 mV DC, or 100Ω range.
1	Depressed	Sets DMM to .1:1 ratio, 1V DC or AC, or 1 kΩ range.
10	Depressed	Sets DMM to 1:1 ratio, 10V DC or AC, or 10 kΩ range.
100	Depressed	Sets DMM to 10:1 ratio, 100V DC or AC, or 100 kΩ range.
1K	Depressed	Sets DMM to 100:1 ratio, 1000V DC or AC, or 1 MΩ range.
10K	Depressed	Sets DMM to 10 MΩ range. NOTE: If the KΩ option is installed and the DMM is in any function other than KΩ, when the 10K switch is depressed the DMM automatically shifts to the 1K range.
AUTO	Depressed	Enables automatic ranging in all functions.
REM	Depressed	Enables remote programming of either manual ranges or automatic ranging.

Table 3-1. Operating Controls, Indicators, and Connectors (Cont.)

CONTROL, INDICATOR OR CONNECTOR	POSITION OR CONDITION	FUNCTION
FRONT PANEL		
Function Indicators (A6DS1-A6DS8)	Lighted	Indicates which function has been selected in either manual control or remote programming.
Function Switches (Pushbutton Switch A6S1) The EXT REF, DC, AC,KΩ, and REM switch sections are interlocked. Depressing one section releases other interlocked depressed section.		NOTE: The EXT TRIG switch is disabled if neither the Data Output nor Remote Programming options are installed in the DMM. The PRINT or REM switch is disabled if the associated Data Output or Remote Programming option is not installed in the DMM.
EXT TRIG	Depressed	Enables external control of sampling rate. Disables DMM rate control.
PRINT	Depressed	Connects Data Output to external transfer lines.
FILT	Depressed	Activates filter circuitry to supress signal input noise.
EXT REF	Depressed	Enables ratio measurement. Disables internal reference and enables external reference voltage to be routed to the Reference Amplifier.
DC	Depressed	Enables DC voltage measurement and DC millivolts measurement.
AC	Depressed	Enables AC voltage measurement.
KΩ	Depressed	Enables kΩ + Ω resistance measurement.
REM	Depressed	Enables remote programming of FILT, EXT REF, DC, AC, KΩ, and Sampling Rate. The DMM automatically selects DC if no function has been programmed.
MV		Enables adjustment of front panel numeral readout to 00.000 when DMM is in millivolt measurement mode with .1 range switch depressed and signal input leads connected together.

Table 3-1. Operating Controls, Indicators, and Connectors (Cont.)

CONTROL, INDICATOR OR CONNECTOR	POSITION OR CONDITION	FUNCTION
REAR PANEL		
A4J3 (Connector)		Enables connection of line power to DMM power supply.
115-230 (Slide Switch A4S1)	115	Enables DMM operation on 105-125 VAC line power.
	230	Enables DMM operation on 210-250 VAC line power.
A2J2 (Connector)		Enables connection of DMM Data Output Circuitry to external equipment.
A2J1 (Connector)		Enables connection of DMM Remote Programming circuitry to external equipment.
HI, LO, +, – and GUARD (Connectors J1 to J5 respectively) In parallel with associated front panel connectors.		Same as associated front panel connectors.

The following test equipment is required to perform the operational checkout.

1. DC voltage source, 100mV to 1000V.
2. DC 10V source.
3. AC voltage source, 1V to 1000V rms, 100kHz, if AC measurement option included.
4. Decade resistance box, 100Ω to 20MΩ, if resistance measurement option included.
5. A parallel bit input, DTL/TTL compatible recorder and one 50-pin connector, Amphenol No. 75-10500 with connecting cable, if Data Output option included.
6. A 50-pin connector, Amphenol No. 75-10500 with connecting cable, if Remote Programming option included.

PRELIMINARY PROCEDURE

NOTE

In the guarded Signal Input Cable the red and black leads are the high and low signal input leads respectively. The green lead is used to terminate the instrument guard shield at the signal source. Whenever applicable, except in the 4-wire ohms measurement mode, the green lead free end should be connected to the center of the source impedance. In the 4-wire measurement mode the green lead must either be terminated at the source shield, if there is a shield, or left unterminated. At all other times the green lead free end should be connected to the black lead. The Reference Cable yellow and the Signal Cable black leads are the external reference voltage input leads when the DMM is in the external reference function. In the 4-wire ohms measurement mode the yellow and blue leads are the current path for the internally generated current that is applied to the external resistance.

1. Connect the Signal Input Cable, red, black, and green and the Reference Cable yellow, blue, and green leads to the corresponding colored front panel connectors. Connect the free ends of the red and black leads together.
2. Position the rear panel line voltage switch to 115 or 230, dependent upon the AC line power available.
3. Insert the DMM power plug into a 3-wire, 105-125V or 210-250V, 50-440Hz power outlet.
4. Position the DMM front panel switches as indicated in Table 3.2. Pushbutton switches should be depressed until they latch in the depressed position. To expedite the checkout procedure, changes in DMM and test equipment controls and connections should be made only as directed in the procedure steps.

Table 3-2. Initial Position of DMM Front Panel Switches

SWITCH	POSITION
1	Depressed
EXT TRG	Unlatched
PRINT	Unlatched
DC	Depressed
POWER-RATE	Full clockwise

CHECKOUT PROCEDURE

After the DMM has warmed up for 30 minutes perform the checkout procedure as follows:

DC Voltage Measurement

CAUTION

To avoid damaging the DMM do not apply more than 1100 VDC to the input terminals when the DMM is in the millivolt or volt measurement mode.

1. Connect the DMM red (HI) and black (LO) signal input leads to the 100mV to 1000VDC source with the red lead to the voltage source negative terminal.
2. Observe that the DMM front panel DC function indicator is lighted. Adjust the voltage source output to 1.00000V and observe a DMM front panel readout of −1.00000.
3. Reverse the red and black lead connections to the voltage source. Observe a DMM readout of +1.00000.

4. With the DMM still in the 1V range, increase the DMM signal input to 2V. Observe a DMM readout of +1.20000 with the 0000 portion blinking on and off. This readout indicates an out-of-range condition.

5. Depress the DMM 10 switch. Adjust the DMM signal input to 10.0000V and observe a DMM readout of +10.0000.

6. Depress the DMM 100 switch. Adjust the DMM signal input to 100.000V and observe a DMM readout of +100.000.

7. Depress the DMM 1K switch. Adjust the DMM signal input to 1000.00V and observe a DMM readout of +1000.00.

8. Adjust the DMM signal input to zero. Disconnect the DMM red and black leads from the voltage source and connect them together.

9. Depress the .1 switch. If necessary, vary the DMM front panel MV screwdriver adjustment until the readout is 00000.

10. Connect the DMM red and black leads to the DC voltage source. Adjust the voltage source output to 100.000 mV and observe a DMM readout of 100.000.
11. Adjust the DMM signal input to OV.

Automatic Ranging

1. Depress the DMM AUTO switch.

2. Vary the DMM signal input amplitude from 1 VDC to 1000.00 VDC and back to 1V, observing at what approximate points the DMM upranges and downranges. With an increasing signal input the DMM upranges each time the readout increases above approximately 119999. With a decreasing signal input the DMM downranges each time the readout decreases below 10000.

Ratio Measurement

NOTE

Table 3-3 shows the DMM front panel numerical readout versus actual ratio values for various signal input voltages, assuming a constant external reference voltage of +10.0000V.

1. Depress the DMM .1 and EXT REF switches. Observe that the EXT REF function indicator is lighted.

2. Connect the DMM yellow (+) lead to a 10 VDC reference source with the yellow lead to the voltage source positive terminal and the black lead to the negative terminal. Adjust the reference voltage to 10.0000V.

3. Adjust the DMM signal input to 100.000 mV and observe a DMM readout of 100.000 (see Table 3-3).

4. Depress the DMM 1 switch. Adjust the DMM signal input to 1.00000V and observe a DMM readout of 1.00000.

5. Depress the DMM 10 switch. Adjust the DMM signal input to 10.0000V and observe a DMM readout of 10.0000.

6. Depress the DMM 100 switch. Adjust the DMM signal input to 100.000V and observe a DMM readout of 100.000.

7. Depress the DMM 1K switch. Adjust the DMM signal input to 1000.00V and observe a DMM readout of 1000.000.

8. Adjust the two voltage source outputs to zero and disconnect from the DMM.

Table 3-3. DMM Readout Versus Actual Ratio Values

External Reference Voltage: +10.0000V		
Signal Input Voltage	**DMM Readout**	**Actual Ratio Value**
.000001	00.001	.0000001:1
.100000	100.000	.010000:1
1.00000	1.00000	.100000:1
10.0000	10.0000	1.00000:1
100.000	100.000	10.0000:1
1000.00	1000.00	100.000:1

AC Voltage Measurement

CAUTION

To avoid damaging the DMM, the signal input volt-hertz product must not exceed 2×10^7.

1. Depress the DMM front panel 1 and AC switches. Observe that the AC function indicator is lighted.

2. Connect the DMM red and black leads to a 1 to 1000V rms, 1 kHz AC source.

3. Adjust the DMM signal input to 1.00000V and observe a DMM readout of 1.00000.

4. Depress the DMM 10 switch. Adjust the DMM signal input to 10.0000V and observe a DMM readout of 10.0000.

5. Depress the DMM 100 switch. Adjust the DMM signal input to 100.000V and observe a DMM readout of 100.000.

6. Depress the DMM 1K switch. Adjust the DMM signal input to 1000.00V and observe a DMM readout of 1000.00.

7. Adjust the DMM signal input to 10V.

RATE

1. Depress the front panel AUTO switch.

2. With the POWER-RATE switch rotated full clockwise, rapidly vary the DMM signal input and observe that the DMM readout changes about five times per second.

3. Rotate the POWER-RATE switch counterclockwise to a point just prior to OFF. Rapidly vary the signal input and observe that the readout changes about once per second.

4. Adjust the DMM signal input to zero. Disconnect the AC source from the DMM.

Resistance Measurement

CAUTION

To avoid damaging the DMM do not apply more than 220V rms to the input leads when the DMM is in the resistance measurement function.

1. Depress the 1 and KΩ switches. Observe that the KΩ function indicator is lighted.

2. Connect the DMM red, black, green, yellow and blue leads to the decade resistance box terminals exactly as shown in Figure 3-1. Do not stack leads by plugging one lead into another. If there is no shield, leave the green lead unterminated.

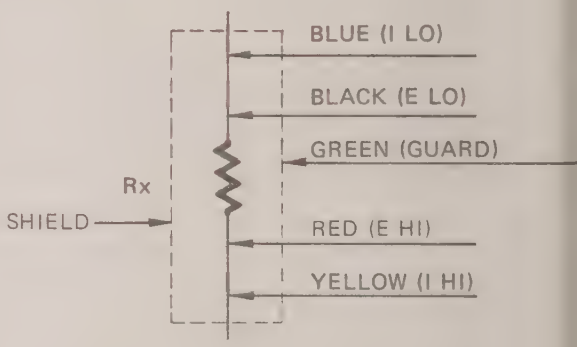


Figure 3-1. Four-Wire Ohms Measurement

3. Adjust the resistance box to 1 kΩ and observe a DMM readout of 1.00000.

4. Depress the DMM 10 switch. Adjust the resistance box to 10 kΩ and observe a readout of 10.0000.

5. Depress the DMM 100 switch. Adjust the resistance box to 100 kΩ and observe a readout of 100.000.

6. Depress the DMM 1K switch. Adjust the resistance box to 1000.00 kΩ and observe a readout of 1000.00.

7. Depress the DMM 10K switch. Adjust the resistance box to 10,000.0 kΩ and observe a readout of 10000.0.

8. Depress the DMM .1k switch. Adjust the resistance box to 100.000Ω and observe a readout of 100.000.

9. Disconnect the resistance box from the DMM.

NTERFACE CHECKOUT

Data Output

To perform the parallel-bit Data Output operational heckout, proceed as follows:

. Using an Amphenol 50-pin connector, connect the recorder to DMM rear panel connector A2J2 (Figure 3-2).

. With the exception of the PRINT switch, position the DMM front panel switches to the initial position listed in Table 3-2. Depress the PRINT switch. Observe that the PRINT function indicator is lighted.

. Perform the DC Voltage, Ratio, AC Voltage, and Resistance Measurement checkout procedures, observing that the recorder indicates the correct DMM function and DMM front panel readout.

emote Programming

Using an Amphenol 50-pin connector, connect a Programmer or test setup to DMM rear panel connector A2J1 (Figure 3-3).

NOTE

When the Range REM switch is depressed, any other range switch that was depressed is released. When the Function REM switch is depressed, if the EXT REF, DC, AC, or KΩ switch was depressed it is released. If the FILT switch was depressed, it remains latched but is disabled as long as the REM switch is depressed.

Rotate the POWER-RATE switch to ON. Depress the Range REM and Function REM switches. Observe that the REM function indicator is lighted.

3. Connect the DMM signal input leads together.

NOTE

In the following procedure only the function indicators will light and the decimal point change location as various functions and ranges are programmed. If it is desired to have the DMM make actual measurements, an input must be applied to the instrument. If the DMM EXT TRIG switch is not depressed the measurements will occur from one to five times a second, dependent upon the setting of the POWER-RATE switch. If it is desired to externally control the measurement rate the front panel EXT TRIG switch must be depressed and if a Programmer is connected to the DMM, the Programmer must be adjusted to control the measurement rate. If the test setup shown in figure 3-3 is used the EXT TRIG switch (Pin 39) must be closed each time a measurement is desired.

4. Program kΩ and observe that the DMM front panel kΩ function indicator is lighted.

5. Successively program R1, R2, R3, R4 and R5. Observe that the decimal location readout is .XXXXX, X.XXXX, XX.XXX, XXX.XX, and XXXX.X respectively.

6. Program DC and observe that the DMM front panel DC function indicator is lighted.

7. Program RO and observe that the decimal location readout is XX.XXX (mV)

8. Successively program EXT TRIG, AC, EXT REF, and FILT and observe that the associated function indicators are in turn lighted.

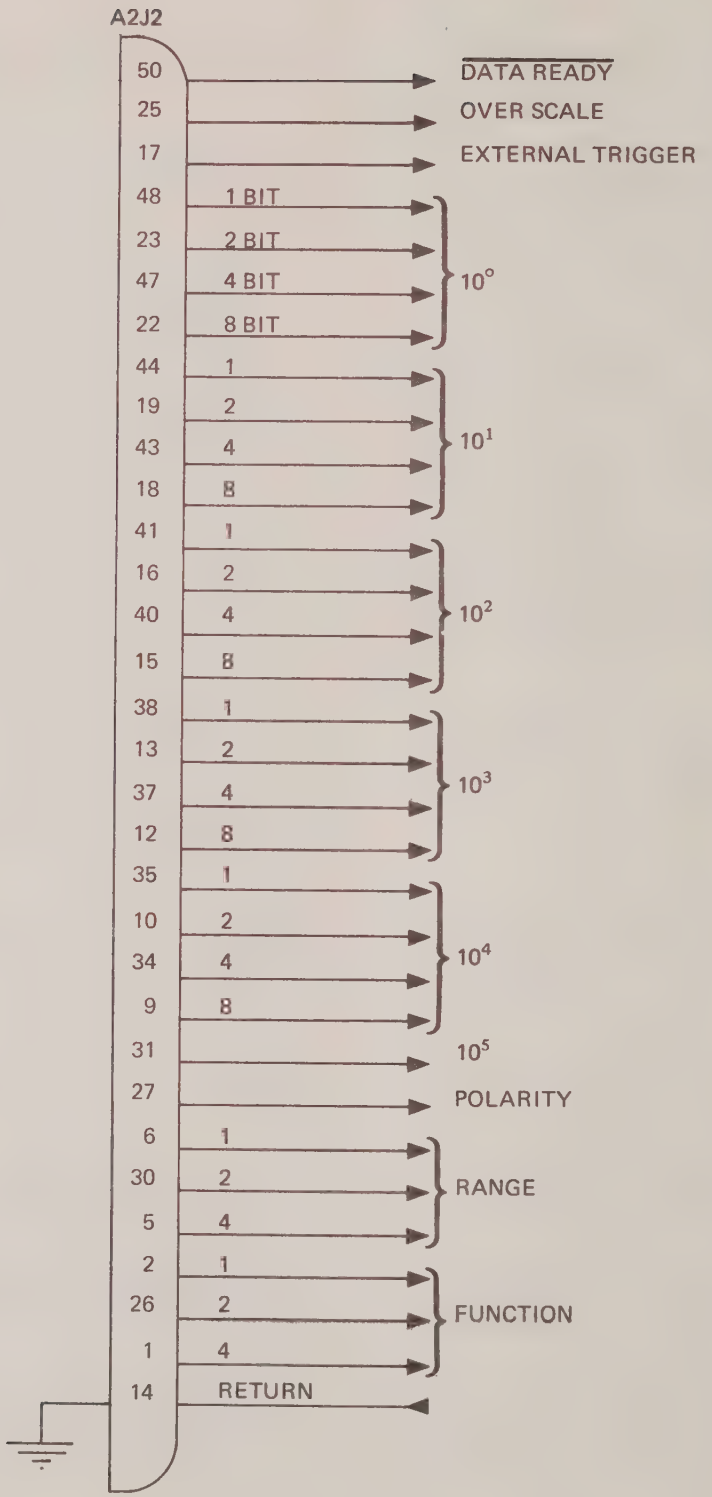
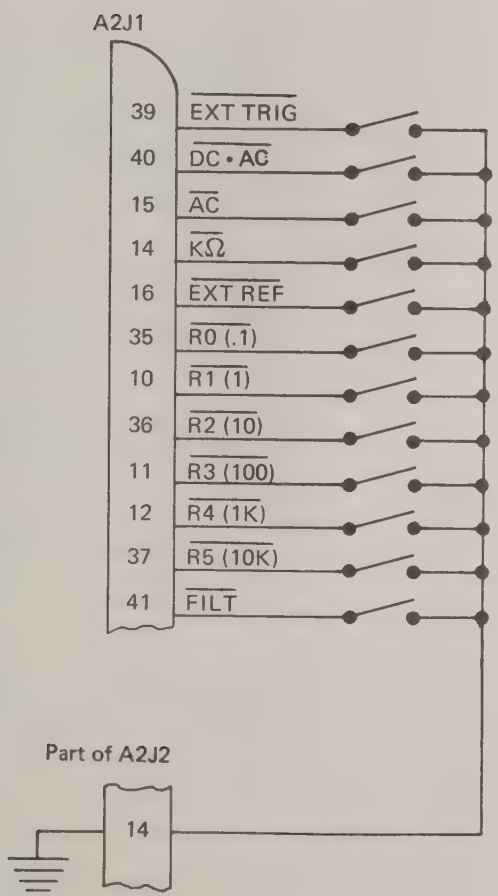


Figure 3-2. DMM – Recorder Interface Connections



NOTE:

When a manual range is not programmed the DMM is in autorange.

Figure 3-3. DMM – Remote Programmer Interface Connections

SECTION IV
CALIBRATION PROCEDURES

GENERAL

This section contains procedures for calibrating the DMM 50. Procedures are included for all options available for the instrument. In performing the calibration procedures, simply omit procedural steps for options not installed in your particular instrument.

The accuracy of calibration depends on the use of quality test equipment. Test equipment employed should be as good or better than the equipment specified for use in the procedures. For example, if an accurate DC Voltage Calibrator capable of supplying 1000 volts is not available, a lower voltage may be substituted. The accuracy of calibration will be proportionately less, however, as the voltage is decreased.

Before calibrating the instrument, it must be placed in the environment of the work area for 30 minutes to allow the internal temperature to stabilize.

For location of test points and calibration controls, refer to the assembly diagrams in Section VI of this manual.

CALIBRATION PROCEDURES

The following equipment is required to perform the calibration procedures:

1. Five-digit Digital Voltmeter (DVM) with 20% overrange, Cimron Model DMM 50 or equivalent.
2. DC Voltage Calibrator, Fluke Model 332A or equivalent.
3. AC Calibrator, Hewlett Packard Model 745A with High Voltage Amplifier, Model 746A or equivalent.
4. Precision resistors.

CALIBRATION OF BASIC INSTRUMENT

Calibration procedures for the basic DMM 50 are provided on the guard shield plate under the top cover of the instrument, and in the following paragraphs. It is recommended that the DMM 50 be calibrated periodically according to usage in accordance with the instructions on the guard shield plate. An instrument in use every day requires calibration every six months.

The calibration procedures presented in the following paragraphs are intended primarily for situations in which components have been replaced, the instrument has been misaligned, or the instrument cannot be calibrated by the procedure provided with the DMM 50.

Turn On and Initial Checks

Proceed as follows to ensure that power supply outputs are acceptable before calibrating the instrument.

a. Turn DMM 50 POWER and RATE switch fully clockwise.

b. Measure +20 VDC supply; should be +19.8 ± .2 VDC. The 120-Hz ripple must be less than 5 mv and total p-p noise should be less than 100 mv.

c. Measure −20 VDC supply; should be −19.8 ± .2 VDC. The 120-Hz ripple must be less than 5 mv and total p-p noise should be less than 10 mv.

d. Measure +5 VDC supply; should be +4.8 ± .1 VDC. Total p-p noise should be less than 10 mv.

e. Measure +15 VDC supply; should be +14.75 ± .5 VDC. Total p-p noise should be less than 200 mv.

f. Measure −15 VDC supply; should be −14.75 ± .5 VDC. Total p-p noise should be less than 100 mv.

g. Measure +10 VDC integrator supply; should be −10 ± .5 VDC. Total p-p noise should be less than 10 mv.

h. Measure −10 VDC integrator supply; should be −10 ± .5 VDC. Total p-p noise should be less than 10 mv.

i. Measure +10 VDC comparator supply; should be +10 ± .5 VDC. Total p-p noise should be less than 20 mv.

j. Measure −10 VDC comparator supply; should be −10 ± .5 VDC. Total p-p noise should be less than 50 mv.

Integrator Operational Check

a. Connect Tektronix 453 or equivalent as follows: Probe at TP5 and probe ground at front end of C3. Connect external trigger to TP2 on digital board. Set horizontal to 5 ms/cm and vertical to 5V/cm.

b. With DMM input shorted, the scope trace should be a straight line with the DAC stepping to either a plus or minus approximately 10V at about 8-1/3 ms. It should remain at this voltage for approximately 3 ms and then start stepping back towards zero in 11 steps of approximately .33 ms each. At the end of DAC time, the trace should remain at very nearly zero during Ex and Er time. Apply +1 volt to the input and observe a minus polarity check pulse just prior to a plus DAC set 11 pulse.

The DAC should make 11 steps back toward zero. At the end of DAC time, Ex should ramp negative to approximately 2 volts. At the end of Ex time, Er should ramp back towards zero. At the end of Er time, the trace should remain at zero until the next measurement cycle is started. As the input voltage is increased from +1.0, to 2.0 to 3.0, etc. the trace should look the same except that for each 1V increase at the input, the DAC should show one less step on the scope trace. Reverse the input for −1.0V, 2.0V, etc. and the patterns on the scope should be the same as for plus input except that it will be inverted.

Auto Zero Loop Noise

a. Connect scope to end of R115 opposite E21. Wideband noise during zero time should be less than 300 mv p-p.

Calibration

The following calibration must be made with a DC standard with an accuracy of at least ±.001% of range. DMM should be warmed up for 1 hour with covers on.

a. +0.0010 adjust. Set DMM in the 10V range. Apply +1.0010 to the input of the DMM. Reduce the +1.0010 to +0.0010. Adjust R139 so that DMM readout shows +0.0010 to +0.0009.

b. −0.0010 adjust. Apply −1.0010 then reduce to −0.0010. Adjust R138 for DMM readout of −0.0010 to −0.0009. Adjust F.P. mv zero for ±00000 in the 100 mv range. Repeat steps (a) and (b).

c. −10.1000 adjust. Apply −10.1000 VDC to DMM input and adjust R37 for DMM readout of −10.1000 to −10.0999.

d. −1.0000 adjust. Apply −1.1000 VDC to DMM input and note readout. Reduce input to −1.0000 and adjust R100 for exactly 1000 digits less than reading noted.

e. +1.0000 adjust. Apply +1.1000 VDC to DMM input and note readout. Reduce input to +1.0000 VDC and adjust R104 for exactly 1000 digits less than reading noted.

f. Repeat steps (a) thru (e) until proper readings are obtained.

g. Apply +10.1000 VDC and note readout. Reading should not differ except for polarity by more than 2 digits from that obtained with −10.1000V input.

h. Check integrator and DAC linearity in both polarities. Apply 1.1000, 2.2000, 3.3000, etc. to 9.9000. Apply 10.1000, 11.1000 and 11.9990. Perform these checks in both polarities. Readings

should not differ from the standard by more than 2 digits.

i. Check and readjust F.P. mv zero in lowest range.

j. Place DMM in the 1000 VDC range. Apply −1010.00 DC. Adjust R5 for a readout of −1010.00V. Apply +1010.00 VDC and note readout. Reading should not differ except for polarity by more than 2 digits.

k. Place DMM in the 100 VDC range. Apply −101.000 VDC. Adjust R23 for a readout of −101.000. Apply +101.000 VDC and note readout. Reading should not differ except for polarity by more than 3 digits.

l. Place DMM in the 1 VDC range. Apply −1.01000 VDC, and note readout. Apply +1.01000 VDC and note readout. Readings should not differ from the standard by more than ±3 digits in either polarity. If so, repeat steps (i), (j) and (k).

m. 100 mv adjust. Apply −101.000 millivolts to the input and adjust R199 for a readout indication of −101.000 mv. Apply +101.000 millivolts and note reading. Except for polarity, readings should not differ by more than 4 digits.

n. Comparator zero check. Place DMM in the 1 volt range. Connect oscilloscope as in Integrator Operational Check [step (a)] except that the probe is connected to TP6. Briefly apply +1 volt to the input and then reduce to .00000 volts. The scope trace should start at zero, step to approximately −10 volts during polarity check, step to approximately +10 volts during DAC time, and return within ±5 volts at the start of Ex time. At the end of Ex time, the trace should have ramped back to approximately zero, depending on how the front panel MV zero is set. Briefly apply −1 volt to the input and then reduce to .00000 volts. The waveform for polarity and DAC time should now be inverted. At the start of Ex, the waveform may differ from that observed in plus polarity by up to ±5 volts but should not exceed ±5 volts from zero. At the end of Ex time, the trace should have ramped to within 1 volt of the point observed in plus polarity.

o. Ext. Ref. ±11V reference zero – short the yellow and black input leads together. Depress "EXT REF" function push button. With a bench DVM, monitor and record the negative voltage between TP2 and signal LO (A convenient place to pick up signal LO is at the rear end of C3). Monitor TP3 and adjust R45 for a positive value within 100UV of TP2. (note: TP2 and TP3 are of opposite polarity)

p. Set DMM in the 10V range, depress "EXT REF" push button and short the red and yellow input jacks. Apply the following voltages between the DMM high (red and yellow jack), low input (black jack):

1. Apply +10V. Adjust R39 for a readout indication of +10.0000.
2. Apply +8V. Adjust R30 for a readout indication of +10.0000.
3. Repeat steps 1 and 2 until the front panel readout for the two steps does not differ by more than one digit.

NOTE

The objective in step 1 and 2 is to make the references track properly between +10V and +8V (ex: readout of +10.0000 with +10 to +8V input). This suggests an alternate calibration technique. First, make the DMM indicate the same value with a +10V ratioed input as it does with a +8V ratioed input by adjusting R30. The exact value obtained by adjusting R30 is not important since it can be altered by R39 to obtain a DMM indication of +10.0000. Adjusting R39 does not affect the tracking of the instrument.

q. Re-calibrate the 10V DC range by repeating only step "C" under the DMM 50 Calibration procedure.

AC & OHM CONVERTER CHECKOUT

Initial Checkout

NOTE

The following checkout and calibration must be performed with P1 and P2 properly installed and with the screw in the right rear corner of the converter installed. This screw ties the shield under the converter board to converter signal ground.

a. With the DMM power on and converter board installed, check for +15 VDC ± .75V at cathode end of CR6. Check for −15 VDC ± .75V at anode end of CR7. With DMM input shorted and in AC Function, p-p ripple should be less than 3 millivolts and total p-p noise should be less than 100 millivolts on both supplies.

AC CALIBRATION

a. Allow 1/2 hour warmup with all covers installed. Connect HP745A AC or equivalent Calibrator to DMM input. Place DMM in AC Function and perform the following calibration:

b. AC Zero. With DMM in range "1" apply .00100 VAC 1 KHz and adjust "AC ZERO" (R53) for DMM readout of .00100.

c. 1000 VAC Adjust. With DMM in "1K" range apply 1010.00V 1 KHz and adjust "1 K LO" (R46) for DMM readout of 1010.00 ± .05V. Apply 500.00 VAC 50 KHz and adjust "1 K HI" (C21) for 500.00 readout ± .50 VAC.

d. 1 VAC Adjust. Set DMM in range "1" and apply 1.0100 VAC 1 KHz and adjust "1 LO" (R57) for DMM readout of 1.01000 ±.00005. Apply 1.01000 VAC 50 KHz and adjust "1 HI" (C18) for 1.01000 ± .00050. Apply 1.01000 VAC 100 KHz and note reading. Adjust "1 HI" to optimize reading for 50 KHz = 1.01000 ± .00050 and 100 KHz = 1.01000 ± .00250 max.

e. 10 VAC Adjust. Set DMM in range "10" an apply 10.1000 VAC 1 KHz and adjust "10 LO (R59) for DMM readout of 10.1000 ± .0005. Apply 10.1000 VAC 50 KHz and adjust "10 HI (C25) for 10.1000 ± .0050. Apply 10.1000 VA 100 KHz and note readings. Adjust "10 HI" t optimize reading for 50 KHz = 10.1000 ± .005 and 100 KHz = 10.1000 ± .0250 max.

f. 100 VAC Adjust. Set DMM in range "100" an apply 101.000 VAC 1 KHz and adjust "100 LO (R61) for DMM readout of 101.000 ± .00 Apply 101.000 VAC 50 KHz and adjust "100 HI (C27) for 101.000 ± .050. Apply 101.000 VA 100 KHz and note reading. Adjust "100 HI" t optimize reading for 50 KHz = 101.000 ± .050 an 100 KHz = 101.000 ± .250 max.

g. Repeat the preceding steps, (a) thru (f).

OHMS CALIBRATION

a. Perform ohms calibration using the standard Cim ron four wire input with Red and Yellow lead shorted and Black and Blue leads shorted. Do no short the Guard (Green) lead to either of the othe two pairs. The Guard lead may be tied to th standard resistor box shield to prevent noise on H ohms reading.

b. Ohms Zero. Set DMM in "AUTO" range,connec both pairs of input leads together and make th following adjustments. Adjust "ohm V0" (R22 for DMM readout of .00000. Insert a 1 meg resis tor in series with the Black input lead at the fron panel and adjust "ohm I0" (R26) for DMM readou of .00000. Repeat adjustment until reading i .00000 ± 1 digit with or without the 1 megohn in series with the Black lead.

c. 1K Ohm Adjust. Connect input leads to 1 K ohm standard resistor and adjust "1 K" (R3) fo DMM readout of 1.00000 ±.00004.

d. 10 K Ohm Adjust. Connect input leads to 10 K ohm standard resistor and adjust "10 K" (R6) for DMM readout of 10.0000 ±.00004.

e. 100 K Ohm Adjust. Connect input to 100 K ohm standard resistor and adjust "100 K" (R8) for DMM readout of 100.000 ±.004.

f. 1000 K Ohm Adjust. Connect input to 1 megohm standard resistor and adjust "1000 K" (R10) for DMM readout of 1000.00 ±.04.

g. 10000 K Ohm Adjust. Connect input to 10 megohm standard resistor and adjust "10000 K" (R13) for DMM readout of 10000.0 ± 1.0. Connect input to 5 megohm standard resistor and readout should indicate 5000.0 ± 5.0. If the 5 megohm reading exceeds the ± 5.0, either step (b) was not performed properly or there is too much leakage resistance in the DMM input circuitry.

SECTION V

THEORY OF OPERATION

GENERAL

The DMM 50 combines successive approximations and three step integration to achieve fast measurement speed and normal-mode, noise-rejection at line-related frequencies. A selectable filter permits accurate measurements in the presence of unusually high noise. Auto-zero circuitry is provided to correct amplifier zero drift prior to each measurement cycle.

BLOCK DIAGRAM DESCRIPTION

Figure 5-1 is a block diagram of the DMM 50 analog circuitry and Figure 5-2 is a block diagram of the digital circuitry.

ANALOG

The analog portion consists of input signal conditioning, input buffer, digital-to-analog converter (DAC), bipolar reference, integrator, and comparator circuitry, and associated decoding logic to drive the analog switches.

DIGITAL

The digital portion consists of the crystal-controlled oscillator, decade counters, storage latches, decoder/drivers, display, auto-range, sample-rate generator, and associated decoding logic to generate the required circuitry control.

CONTROL

Figure 5-3 is a block diagram of the control circuitry showing more detail than Figure 5-2. The measurement cycle consists of five phases, controlled by flip-flops SEQ1, SEQ2, SEQ3, and associated logic, namely:

. Phase 1 – zero.

. Phase 2 – polarity selection for the DAC.

. Phase 3 – determination of most significant decade (MSD) through the DAC.

4. Phase 4 – integration of input analog voltage algebraically reduced by the magnitude of the DAC.

5. Phase 5 – integration of the reference voltage.

ANALOG SWITCHES

Figure 5-4 is the analog switching block diagram and truth table for the five phases of the measurement cycle. The function of the switches are as follows:

1. During phase 1:

   a. The signal conditioning circuits are disconnected from the input buffer.

   b. The input buffer is grounded.

   c. The DAC is set to zero.

   d. Long term zero drifts are stored in C27 until the system responds to a START command, indicated by either the sample rate generator or by an external trigger command.

2. During phase 2:

   a. Signal conditioning circuits are connected to the input buffer.

   b. Ground is removed from the input buffer.

   c. Non-linear feedback is switched to the integrator amplifier output.

   d. Zero-drift capacitor C27 is disconnected from the comparator output. The comparator output, at time of disconnect from C27, determines the bipolar reference polarity to be applied to the DAC.

3. During phase 3:

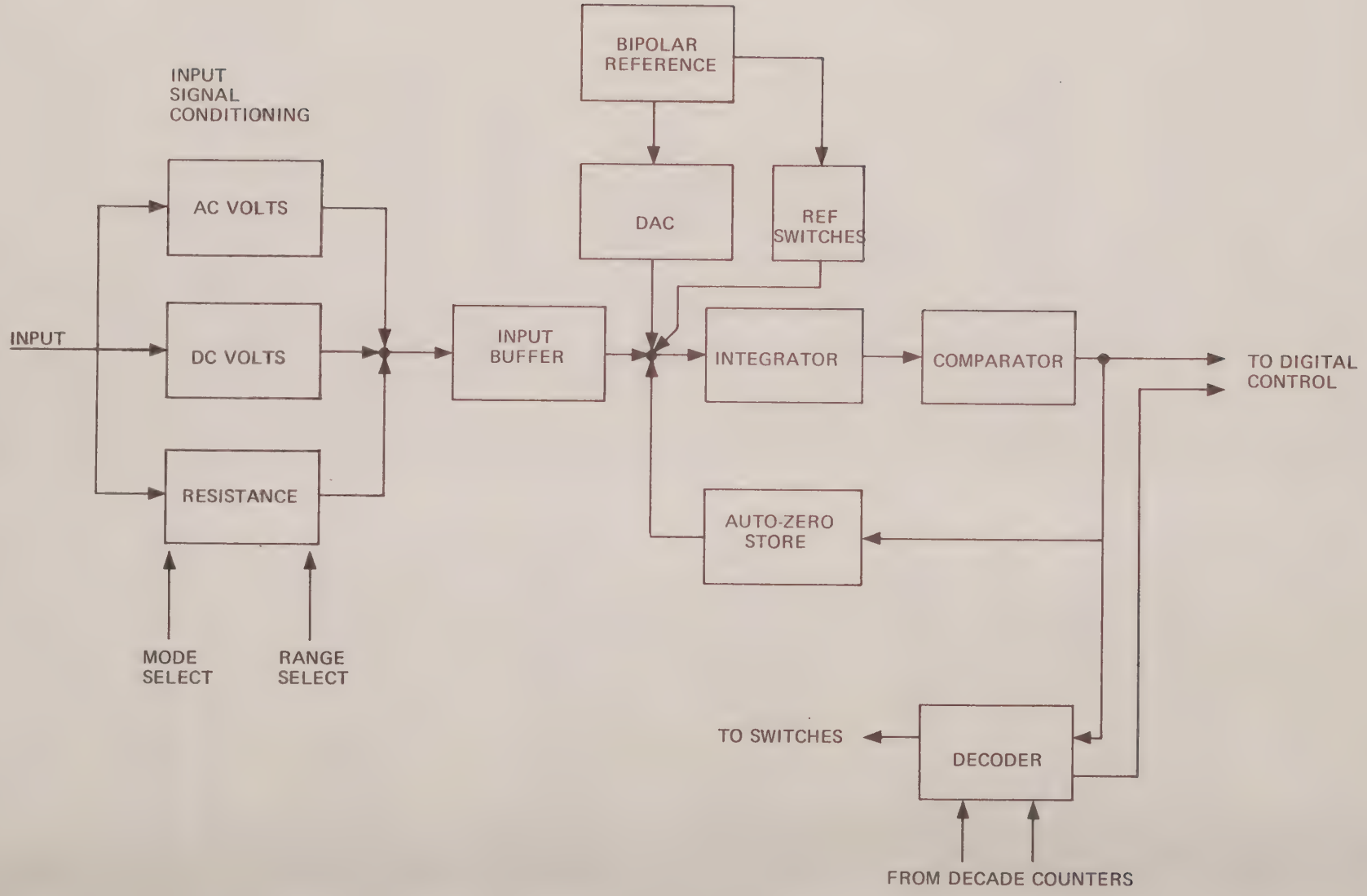


Figure 5-1. DMM 50 Analog Block Diagram

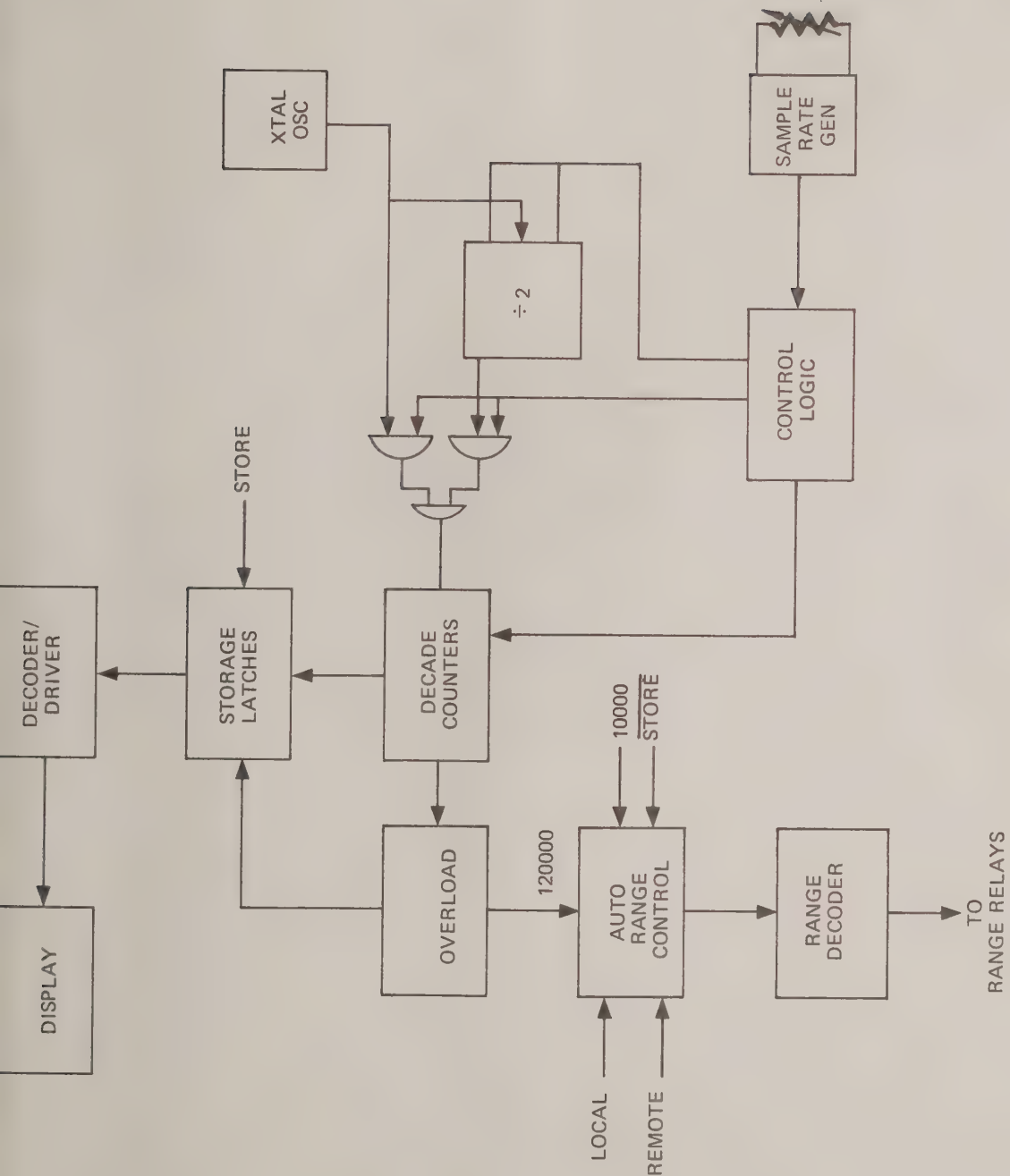
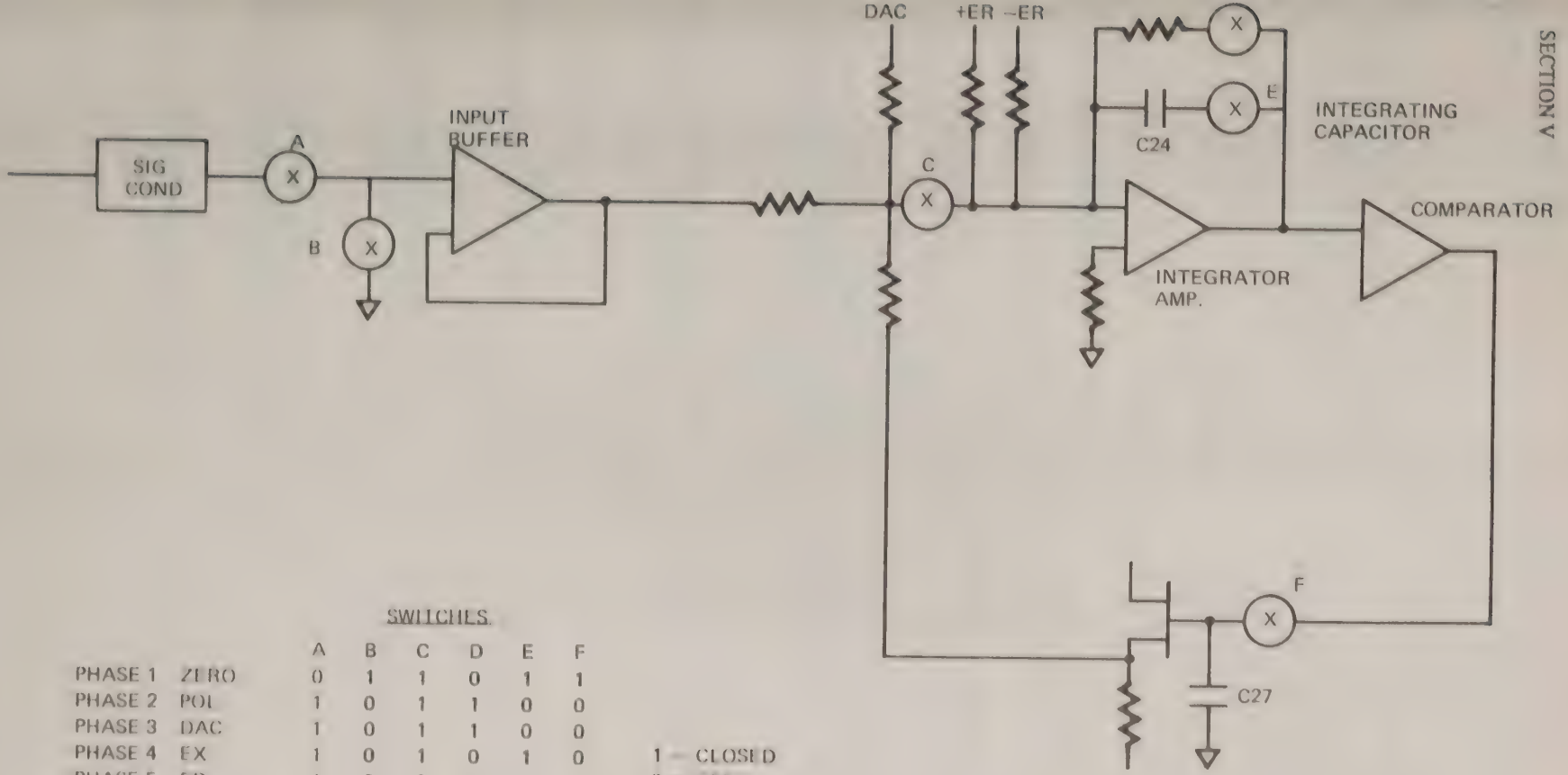


Figure 5-2. DMM 50 Digital Block Diagram



SWITCHES

		A	B	C	D	E	F
PHASE 1	ZERO	0	1	1	0	1	1
PHASE 2	POL	1	0	1	1	0	0
PHASE 3	DAC	1	0	1	1	0	0
PHASE 4	EX	1	0	1	0	1	0
PHASE 5	ER	1	0	0	0	1	0
PHASE 1	ZERO	0	1	1	0	1	1

1 = CLOSED
0 = OPEN

Figure 5-4 Analog Switching Block Diagram

a. The DAC is initially set to plus or minus 11 volts as determined in phase 2.

b. The DAC counts down by one-volt increments until the comparator indicates a zero crossover to terminate the DAC mode; or, the DAC counts down by one-volt increments until the MSD counter contains a zero to terminate the DAC mode.

4. During phase 4:

a. Non-linear feedback around the integrator amplifier is removed.

b. The integrator capacitor is connected to the integrator amplifier output.

c. Integration of the input signal, algebraically reduced by the magnitude of the digital number stored in the most significant decade, proceeds for 16.66 milliseconds, as determined by the crystal oscillator.

d. The result of the 16.66 millisecond integration period appears as a voltage on the integration capacitor.

5. During phase 5:

a. A reference voltage of opposite polarity from phase 4 is integrated to discharge the integrating capacitor linearly to zero.

b. The conversion is completed when the comparator detects a zero crossover and a STOP control signal is generated.

TIMING

Figure 5-5, the timing diagram, represents the sequence of events that control the operation of the logic during the five phases of the measurement cycle.

The measurement cycle is initated by a START signal generated by the sample rate generator (SRG) when in local control, or by an EXTERNAL TRIGGER command when in remote control (Figure 5-3).

The sequence of events following a START command are as follows:

1. Phase 1:

a. SEQ1 is set; SEQ2 and SEQ3 are reset.

b. The decade counters, including the MSD, are reset to zero.

c. The control function $\overline{\text{ZERO}}$ goes low (negative true logic).

d. The control function $\overline{\text{ZERO SW}}$ remains low as the result of the end of the previous measurement cycle phase 5, and the input drift is stored in C27 (Figure 5-4).

e. Phase 1 is completed when the decade counter counts 8000 (8K) pulses of the 600 kHz clock (13.33 ms).

2. Phase 2:

a. Phase 2 is initiated by the positive transition of the 8K logic line.

b. The $\overline{\text{ZERO SW}}$ control line goes high and the analog switches are connected for the DAC polarity determination.

c. The output of the Comparator determines the state of the polarity flip-flop (FF) at the negative transition of the 8000 count.

d. For negative input voltages polarity FF Z18 will be set, and for positive inputs Z18 will be reset.

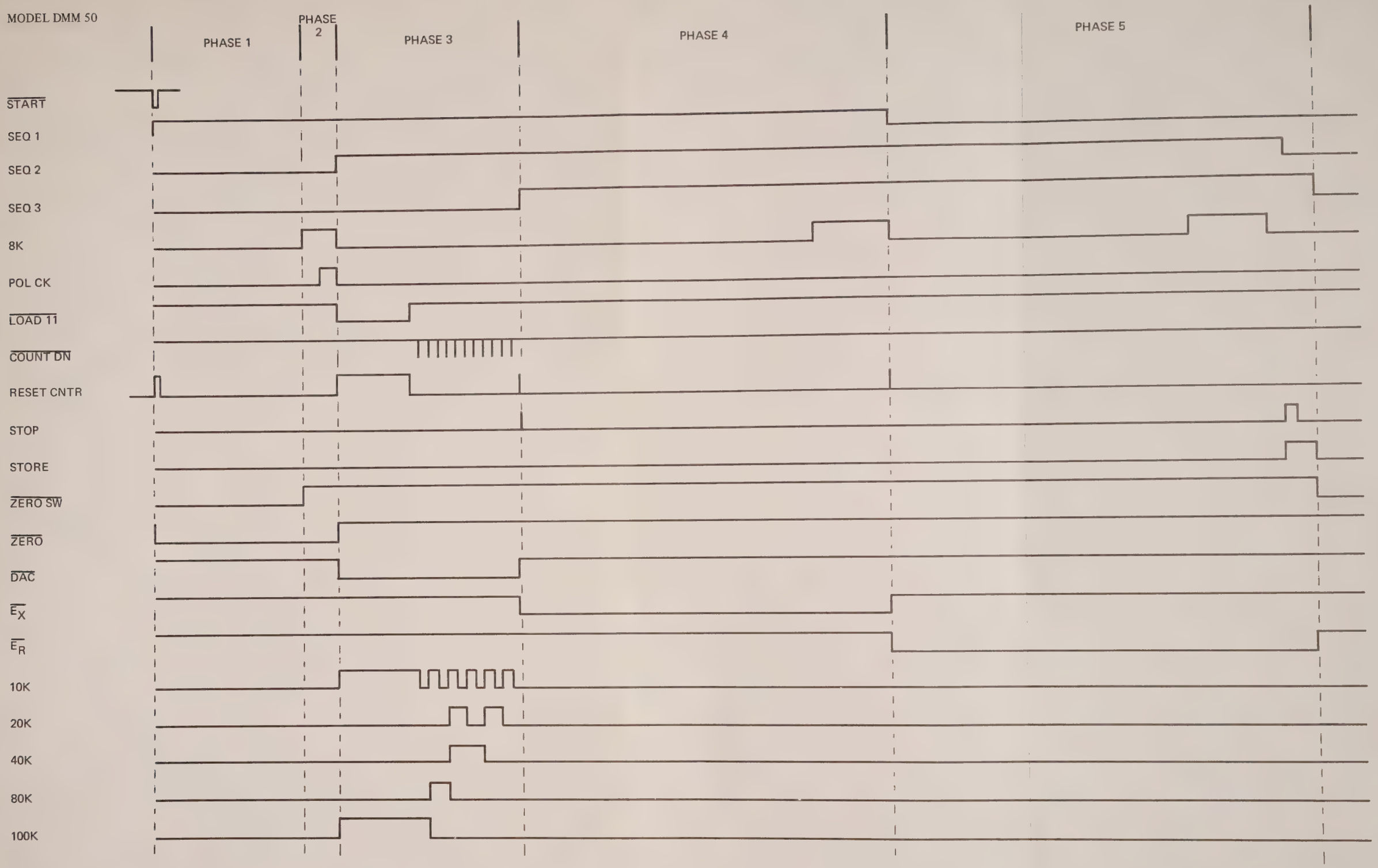


Figure 5-5. DMM 50 Timing Chart

e. If the polarity is the same as the previous reading, the polarity FF will not be toggled and the measurement cycle will proceed to Phase 3.

f. If the polarity FF is changed from the previous reading, a WAIT monostable will be triggered and the measurement cycle will be reset to Phase 1. Then Phase 1 and Phase 2 will be repeated.

g. Phase 2 is completed when the decade counter counts from 8000 (8K) pulses to 10,000 (10K) pulse of the 600 kHz clock (3.33 ms).

. Phase 3:

a. Phase 3 is initated by the negative transition of the 8K logic line.

b. Flip-flop SEQ2 is set.

c. $\overline{\text{Load 11}}$ monostable is triggered.

d. The MSD is set to 11.

e. The decade counter is reset to zero.

f. The $\overline{\text{DAC}}$ control line goes low.

g. When the $\overline{\text{load 11}}$ monostable times out (about 3 ms), the MSD counts down 11, 10, 9, 8, etc., and the DAC decreases its analog voltage by one volt increments.

h. The MSD counts down until the Comparator indicates a zero crossover and generates a STOP command, or the MSD counter contains a zero, to terminate the DAC mode.

Phase 4:

a. Phase 4 is initiated by setting SEQ3.

b. The decade counter is reset to zero.

c. The $\overline{\text{Ex}}$ control line goes low.

d. The integration of the input analog voltage, algebraically reduced by the DAC output voltage, proceeds for 10,000 counts of the 600 KHz clock (16.667 ms).

e. Phase 4 is completed when the negative transition of 8K resets SEQ1.

5. Phase 5:

a. Phase 5 is initiated by resetting SEQ1.

b. The decade Counter is reset to zero and held at zero until the $\overline{\text{Er}}$ monostable times out.

c. The $\overline{\text{Er}}$ control line goes low.

d. The reference voltage of opposite polarity is integrated to discharge the integrating capacitor linearily to zero.

e. The conversion is completed at the zero crossover and a STOP command is generated to reset SEQ2 and the counter stops counting clock pulses.

f. When SEQ2 is reset, the STORE command is generated and the contents of the counters are stored in the storage latches.

g. SEQ3 is reset at the end of the STORE command, the measurement cycle is complete and the $\overline{\text{ZERO SW}}$ control goes low placing the analog switches in the ZERO condition.

h. DAC counts down by one volt increments until the MSD counter contains a zero and the DAC mode is terminated.

SIGNAL CONDITIONING

AC Voltage (Schematic 200426)

In the AC mode of operation, the signal conditioning block full-wave rectifies and filters the input signal so that the output, a DC signal, represents the average value of the sine wave calibrated to read the rms equivalent.

The broad band, active full-wave rectifier consists of an amplifier and associated circuitry. Networks in the

feedback path of the amplifier determine the attenuation required for the selected full scale range. The trim capacitors are adjusted to maintain a fixed gain ratio over a wide dynamic range of input signal frequencies. Automatic or manual range selection controls the attenuator relays.

Differential amplifier A3 and associated circuitry provide for full-wave low-pass filtering of the average DC component of the rectified output. Additional filtering is provided by selecting the active 3-pole filter in the basic instrument.

The full-wave rectified, filtered DC voltage is scaled to one-volt full scale and connected to the DC section by relay K4. The relay selection matrix for the AC mode is as follows:

RANGE	K4	K1	K2	K3
1V	1	0	0	0
10V	1	1	0	0
100V	1	0	1	0
1000V	1	0	0	1

KΩ (Schematic 200426)

In the KΩ mode of operation, the signal conditioning block connects the unknown resistance KΩ to be measured into the negative feedback loop of operational amplifier A1. The KΩ mode is selected by relay K10 and the 4-wire interconnection is selected. The guard connection (P1 pin K) is internally grounded to be utilized as a shield connection to minimize pick up in large ohmic resistors.

The operational amplifier A3 and associated circuitry provides the loop gain required for linearity and gain accuracy. Ohms protection is provided by the unipolar current limiter Q7 and associated circuitry. The output voltage of the ohms amplifier is 1V full scale for the 1K range, 100 mV full scale for the 100Ω range, and 10V full scale for all other ranges. Automatic or manual range selection controls the attenuator relays.

The ohms constant-current attenuator is connected to the +11 volt reference voltage and the relay selection matrix is as follows:

RANGE	K10	K5	K6	K7	K8	K9	CURRENT THRU UNKNOWN RESISTANCE
100Ω	1	1	0	0	0	0	1 milliamp
1 KΩ	1	1	0	0	0	0	1 milliamp
10 KΩ	1	0	1	0	0	0	1 milliamp
100 KΩ	1	0	0	1	0	0	100 microamps
1,000 KΩ	1	0	0	0	1	0	10 microamps
10,000 KΩ	1	0	0	0	0	1	1 microamp

Voltage-offset adjustment R22 and current-offset adjustment R26 are made in the 1K range. A 1-megohm resistor is placed in series with the black lead when adjusting the current offset.

DC Voltage (Schematic 200421, Sheet 1)

In the DC mode of operation, the signal conditioning block provides attenuation of 100 for the 100V and 1000V ranges, signal limiting for overload conditions, and filtering for normal noise rejection.

The 100:1 attenuator consists of R3, R4, and calibration adjustment R5. Input limiting is provided by CR1, CR2 and field effect transistors (FET) Q1-Q2 connected as diodes.

The active, three-pole filter used in both AC and DC measurements, consists of operational amplifier AR3 and associated circuitry. This circuit provides a normal-mode noise-rejection of 60 db at 60 Hz.

The filter is selected by means of a front panel switch or remote control in the DC Ratio, or KΩ modes of operation. During AC operation, the filter is programmed automatically by the function decoding logic.

ANALOG BOARD (Drawing 200421)

BUFFER AMPLIFIER

The input buffer amplifier consists of AR1, AR2, and associated components. The DC differential amplifier is connected as a non-inverting, potentiometric feedback amplifier. AR2 operates at a fixed, closed-loop gain of X19 and provides for an increase in open loop system gain for amplifier AR1. The closed-loop gain of the amplifier is switched from X1, X10, or X100 by FET

switches Q8, Q9, and Q54.

With transistor Q8 ON, transistors Q9 and Q54 are biased OFF, and the closed loop gain of the amplifier is X1. Feedback network resistors R19 and R20 set the forward closed-loop gain of the amplifier at X10 when Q9 is ON, while transistors Q8 and Q54 are OFF. Potentiometer R23 provides an adjustment for calibration purposes. Feedback network resistors R196 and R198 set the closed-loop gain at X100 when Q54 is ON, and Q8 and Q9 are simultaneously OFF. Potentiometer R199 provides an adjustment for calibration purposes.

The amplifier output provides a voltage bias potential to the input FET switches through R15 for X1 gain, when Q7 and Q53 are OFF. For X10 gain Q7 is ON, Q53 is off, and the bias potential is determined by divider R15 and R16. For X100 gain Q53 is ON, Q7 is OFF, and the bias potential is determined by divider R15, R194, and the ON resistance of Q53.

Amplifier AR1 input signal (Pin 3) is connected to signal ground (Q5 ON) during the zero phase of the measurement cycle, and to the input analog voltage (Q3 ON) for the remainder of the measurement cycle. Front-panel zero adjustment is provided by R186 in order to zero out any thermal EMF in the input leads.

REFERENCE

The reference voltage power supplies consist of differential amplifiers AR4 and AR5. The primary reference is the +11V supply and it is dependent upon the stability of reference zener CR10 for long term stability and minimum temperature coefficient. The negative reference supply simply inverts the +11V reference to −11V using operational amplifier AR5.

Reference zener CR10 is selected and aged to insure maximum long term stability and minimum temperature coefficient. Zener current is controlled by series resistor R26 connected to the precise +11 volt reference. Resistor R26 is factory selected to provide minimum temperature coefficient and maximum stability over the operating range of the instrument.

The +11V reference amplifier AR4 is a non-inverting potentiometric feedback amplifier. The feedback network R32 and R31 sets the forward gain at approximately 1.7. Potentiometer R37 provides a gain adjustment for calibration purposes. The selected value of R31 is determined by the absolute value of the zener voltage. Resistor R25 and diode CR9 forward-bias the zener when power is first applied to the instrument.

The −11V reference amplifier AR5 is an inverting operational amplifier. Input resistor R41 and feedback resistor R46 set the forward gain at minus one. The gain accuracy of the inverting amplifier is determined by the precision and stability of these two resistors which form the gain network.

RATIOMETER

The instrument may be operated in the ratiometer mode of operation by front panel pushbutton control. When ratio is selected, ratio relay K3 is energized and the external reference is connected to the input of amplifier AR4. The feedback network R38, R39, and R40 sets the forward gain for ratio.

DIGITAL-TO-ANALOG CONVERTER

The Digital-to-Analog Converter (DAC) provides a bipolar reference voltage in one-volt increments to algebraically reduce the input analog voltage to less than one-volt full scale for the integration cycle of the measurement. Figure 5-6 is a simplified presentation showing the operating principles of the DAC.

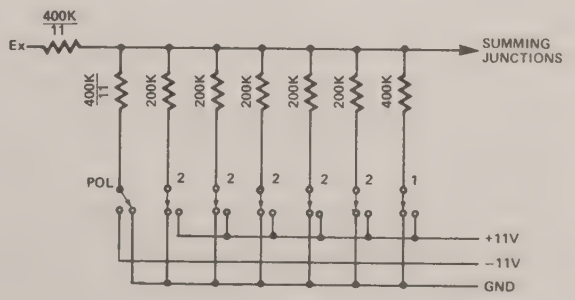


Figure 5-6. DAC Operating Principles.

When the DMM 50 is in the negative polarity, the polarity switch is grounded as shown in Figure 5-6. The magnitude switches are driven by the most significant decade (MSD) and tend to drive the summing junction positive as shown in the following truth table:

MSD					DAC						Eout
1	8	4	2	1	2	2	2	2	2	1	
1	0	0	0	1	1	1	1	1	1	1	+11V
1	0	0	0	0	1	1	1	1	1	0	+10V
0	1	0	0	1	0	1	1	1	1	1	+9V
0	1	0	0	0	0	1	1	1	1	0	+8V
0	0	1	1	1	0	0	1	1	1	1	+7V
0	0	1	1	0	0	0	1	1	1	0	+6V
0	0	1	0	1	0	0	0	1	1	1	+5V
0	0	1	0	0	0	0	0	1	1	0	+4V
0	0	0	1	1	0	0	0	0	1	1	+3V
0	0	0	1	0	0	0	0	0	1	0	+2V
0	0	0	0	1	0	0	0	0	0	1	+1V
0	0	0	0	0	0	0	0	0	0	0	+0V

When the DMM 50 is in the positive polarity, the polarity is connected to the −11V sequence. Since the polarity resistor $\frac{400K}{11}$ equals the parallel combination equivalent resistance of the magnitude switches, the DAC switches are connected in the 1's complement for positive polarity as shown in the following truth table.

MSD					DAC						Eout
1	8	4	2	1	2	2	2	2	2	1	
1	0	0	0	1	0	0	0	0	0	0	−11V
1	0	0	0	0	0	0	0	0	0	1	−10V
0	1	0	0	1	0	0	0	0	1	0	−9V
0	1	0	0	0	0	0	0	0	1	1	−8V
0	0	1	1	1	0	0	0	1	1	0	−7V
0	0	1	1	0	0	0	0	1	1	1	−6V
0	0	1	0	1	0	0	1	1	1	0	−5V
0	0	1	0	0	0	0	1	1	1	1	−4V
0	0	0	1	1	0	1	1	1	1	0	−3V
0	0	0	1	0	0	1	1	1	1	1	−2V
0	0	0	0	1	1	1	1	1	1	0	−1V
0	0	0	0	0	1	1	1	1	1	1	−0V

The DAC resistor ladder network is a precision ratioed match set and consists of R106, to R114 (schematic 200421, sheet 2). The DAC voltage switches connect the resistor ladder network to either the reference voltage or to signal ground (schematic 200421, sheet 1).

Two types of DAC switches are used: one for the magnitude bits of the MSD and one for the polarity bit. Resistor Q23A is on, Q23B is off and the DAC is effectively connected to the reference supply. When a positive voltage is applied to the base of Q23A, it is turned on, biasing Q24A off through diodes CR17A and CR18A. When low voltage (logic zero) is applied to the base of Q23A, it is turned off, biasing A24A on through R87A.

INTEGRATOR

The Integrator (schematic 200421, sheet 2), is a high-gain, differential, operational amplifier with feed-forward compensation to increase slew rate and bandwidth. The circuit is connected as an operational amplifier, having an input summing resistor of $\frac{400K}{11}$ ohms and a 0.1 microfarad capacitor in the feedback.

During Phase 1, Phase 4 and Phase 5 of the measurement cycle, integrating capacitor C24 is connected in the feedback loop by FET switch Q35 on (Q45 off) and the circuit functions as an integrator. During Phase 2 and Phase 3, Q35 is off, Q45 is on, and the amplifier functions as a high-gain, operational, inverting amplifier, The gain is controlled by feedback network R167, R168, CR39, CR40, and C21.

Integrating capacitor C24 is switched out of the circuit during Phase 2 and Phase 3 to avoid leaving any residual charge on the capacitor at the start of the EX cycle. At the start of the EX cycle, Q35 is on, Q45 is off and the integration of the input analog voltage, algebraically reduced by the DAC voltage, begins and proceeds for 16.66 ms. The integrator output voltage varies at a rate controlled by the constant current which is equal to $\frac{(EX\text{-}EDAC)}{400K}\frac{1}{11}$ for positive polarity or $\frac{(-EX + EDAC)}{400K}\frac{1}{11}$ for negative polarity. Charging of the feedback capacitor by the constant-current source produces a linear ramp at the output of the Integrator.

At the start of Phase 5, the ER cycle, FET parallel witches Q30 and Q48 disconnect the input voltage from he Integrator and the opposite polarity reference volt- ge is selected by either Q28 or Q29. The selected ref- rence voltage discharges the integrating capacitor linear- ly to zero volts. At this time, the comparator senses the ero-crossing and causes the reference integrator time to top. The accumulated counts in the counter at this time qual the number displayed on the front panel readout.

COMPARATOR

The Comparator (schematic 200421, sheet 2) is a high gain non-inverting differential operational amplifier. The circuit is a non-inverting amplifier without negative feed- back. The Comparator (or zero detector) has two out- puts. One is connected to the digital logic through em- mitter follower Q41; the other feeds zero drift storage capacitor C27 through FET switch Q47.

FET SWITCHING

The four digital lines that control the analog switches during the 5 phases of the measurement cycle are located on the analog circuit board (schematic 200421, sheet 2). The analog switches are N-Channel field-effect, junction transistors. They are driven by level shifting circuitry composed of discrete components.

Since the level shifting circuitry is identical in opera- tion, only one control channel is discussed in detail. The $\overline{\text{ZERO SW}}$ level shifter consists of Q25, Q26, Q27, and associated components. When $\overline{\text{ZERO SW}}$ control line is a logic "0", Q25, Q26 and Q27 are OFF. The collector of Q26 is −20 volts and the collector of Q27 is +20 volts. When $\overline{\text{ZERO SW}}$ is a logic "1", Q25, Q26, and Q27 are ON; then Q26 collector is +20 volts and Q27 collector is −20 volts.

The ±20 volts logic signal lines control the FET switch- es thru series diodes connected to their gates. The field- effect transistors are cutoff when the voltage at the gate is negative with respect to the drain and source. The field-effect transistors are turned on when the +20 volts control lines back-bias the series diodes to the gate. Under this condition, no current flows through the resis- tor connected between drain and gate of the FET and they are at the same potential (zero volts bias).

DIGITAL CIRCUITRY (Drawing 200441, Sheet 2)

The digital circuitry includes the sample rate generator, clock, counters, storage and display, range counter and decoding, DAC decoder and driver, and control circuitry. The digital circuitry is entirely constructed with inte- grated circuits with the exception of a few transistors used in the sample rate generator, the polarity drivers, the overrange one driver, and logic delay elements.

SAMPLE RATE GENERATOR

The sample rate generator (SRG) consists of transis- tors Q7, Q8, and associated circuitry. The internal sam- ple rate which initiates each measurement cycle is gen- erated by the charge and discharge of capacitor C25. The front-panel RATE CONTROL varies the charging current in the capacitor. When the voltage on the capa- citor equals the emitter voltage of Q7, the unijunction fires and discharges the capacitor. Transistor Q8 pro- vides an output voltage level compatible with TTL logic. The rate is variable from approximately one pulse per second to five pulses per second.

The output of the SRG is connected to Z56-2 and may be blocked by the front-panel external trigger con- trol. The display is held until a new trigger is generated. In addition, each measurement cycle may be remotely triggered from an external source through Z56-13, when the remote programming option is installed.

CLOCK AND COUNTER (Sheet 1 of Drawing 200441)

The crystal-controlled clock is a series-mode crystal circuit and consists of crystal Y1 and Z64. It generates 1.2 mHz pulses which drive a divide-by-two flip-flop Z54. The 600 kHz clock pulses from flip-flop Z54 are gated into the counters during all phases.

The counter chain consists of Z18 thru Z23, Z18 is the overrange 10^5 one bit, Z19 is the most significant decade, and Z20 through Z23 are the four lower-order

decades. Z19 is a BCD up/down counter and Z20 through Z23 are BCD decade counters.

The decade counter chain provides the basic timing clock signals during phase 1 and 2, generates the clock signals for the MSD during phase 3, generates the 16-2/3 millisecond integration cycle during phase 4, and accumulates the count during phase 5.

The outputs of Z22-D and Z21-A are connected to NAND-gate Z32 during phase 3. This generates the 0.33 millisecond clock pulses to drive the MSD counter in the DAC mode of the measurement cycle.

Outputs of the counter chain are transferred through the latching registers, Z9 to Z14, to the 7-bar decoder/drivers Z2 to Z6. Z2 stores the polarity symbol and the overrange 10^5 one bit. Discrete transistors Q2 to Q4 are drivers for the minus, plus, and overrange one bit.

The counter chain is reset to all "zeros" at the beginning of the measurement cycle by $\overline{\text{START}}$ through Z24-10. Also, the counter chain is reset during LOAD 11, at the start of Ex, and at the start of Er, through Z24.

DAC DECODER AND DRIVER (Drawing 200441)

The DAC decoding and driver circuitry provides the logic required to switch the control lines to the DAC resistor ladder network. The control lines 1, 2A, 2B, 2C, 2D, and 2E are the outputs of open collector hex inverter Z45. The positive true or one's complement output code is controlled by polarity flip-flop Z18. When Z18 is a logic "1", the polarity is negative and the output of the DAC decoding circuitry is positive true. When Z18 is a logic "0", the polarity is positive and the DAC output is the one's complement. The following truth table defines the output logic levels:

		10^5	10^4				DAC DRIVER					
	POL	1	8	4	2	1	1	2A	2B	2C	2D	2E
NEGATIVE	1	1	0	0	0	1	H	H	H	H	H	H
	1	1	0	0	0	0	L	H	H	H	H	H
	1	0	1	0	0	1	H	H	H	H	H	L
	1	0	1	0	0	0	L	H	H	H	H	L
	1	0	0	1	1	1	H	H	H	H	L	L
	1	0	0	1	1	0	L	H	H	H	L	L
	1	0	0	1	0	1	H	H	H	L	L	L
	1	0	0	1	0	0	L	H	H	L	L	L
	1	0	0	0	1	1	H	H	L	L	L	L
	1	0	0	0	1	0	L	H	L	L	L	L
	1	0	0	0	0	1	H	L	L	L	L	L
	1	0	0	0	0	0	L	L	L	L	L	L
POSITIVE	0	1	0	0	0	1	L	L	L	L	L	L
	0	1	0	0	0	0	H	L	L	L	L	L
	0	0	1	0	0	1	L	H	L	L	L	L
	0	0	1	0	0	0	H	H	L	L	L	L
	0	0	0	1	1	1	L	H	H	L	L	L
	0	0	0	1	1	0	H	H	H	L	L	L
	0	0	0	1	0	1	L	H	H	H	L	L
	0	0	0	1	0	0	H	H	H	H	L	L
	0	0	0	0	1	1	L	H	H	H	H	L
	0	0	0	0	1	0	H	H	H	H	H	L
	0	0	0	0	0	1	L	H	H	H	H	H
	0	0	0	0	0	0	H	H	H	H	H	H

OVERLOAD

If an end-of-conversion (STOP) pulse is not received during phase 5 by the time the counter reaches 120000, an overload condition exists, and this condition is sensed by Z29-8 going low. One input to Z29 (pin 10) is set high by the 10^5 one bit Z18, pin 15. Another input to Z29 (pin 11) is the 2 bit of Z19 (pin 3), and the other input to Z29 (pin 9) is the $\overline{1}$ bit of Z19 (pin 3) inverted by Z25 (pin 8). The $\overline{12XXXX}$ logic signal indicates an up-range command in auto-range mode of operation, and stops the counter from accumulating additional pulses.

The $\overline{12XXXX}$ low-going signal is inverted by Z64 (pin 6) and connected to Z43 (pin 12). Z43 (pin 8) is high as the result of S2 going true at the beginning of phase 3; therefore, Z43 (pin 11) will go low and stop the clock pulses into Z33.

When the end-of-conversion (STOP) pulse terminates the measurement cycle, the number 120000 is stored in the storage latches. The overscale indication to the BCD option is decoded by Z28 (pin 11) and inverted by Z49-10. The indication to the display is decoded by Z29. One input to Z29 (pin 3) is a neon relaxation oscillator to provide a low frequency clock pulse to blank the trailing zeros of the display. Z15 is a divide-by-two binary that drives blanking transistor Q1.

SIGN

DS1 contains the display unit for the polarity indication. It is enabled in the DC MODE only, and is turned on by the data stored in Z9 at the end of the measurement cycle. Q2 turns on the negative symbol and Q3 turns on the positive symbol.

All range selections are controlled by the actions of relays that are controlled by the BCD in range counter Z36. In manual ranging, grounding the appropriate line via the front-panel switch, or a logic zero from the remote programming option, sets the state of the BCD counters. The following truth table defines the BCD code for each range and function:

8421	DC RATIO	AC	KΩ
X000	R0	R1	R1
X001	R1	R1	R1
X010	R2	R2	R2
X011	R3	R3	R3
X100	R4	R4	R4
X101	R4	R4	R5
X110	R4	R4	R5
X111	R4	R4	R5

Where
R0 = .1V DC only
R1 = 1V DC/AC .1KΩ
R2 = 10V DC/AC .10KΩ
R3 = 100V DC/AC 100KΩ
R4 = 1000V DC/AC 1000KΩ
R5 = 10,000KΩ only

In manual range, range counter Z36 is set to the above BCD code by a logic zero on the selected line. In auto range, the output of Z16 (pin 8) is low and the system auto ranges when all input lines are high or unselected.

The BCD number in range counter Z36 is decoded to provide the control lines to the relay drivers, to drive the BCD isolated electrical output option, and to drive the decimal point decoder driver.

Auto ranging is enabled by $\overline{AUTO}$ (Z16-8) being low. Either of two events causes the auto ranging circuitry to change its full-scale range:

1. An overload indicated by a count of 120000 sensed at Z29 (pin 8) $\overline{12XXXX}$.

2. An underrange, indicated by a count under 10000 or a zero in the MSD sensed at Z27 (pin 11) $\overline{00000}$.

The system will up-range at $\overline{12XXXX}$ or down-range at $\overline{<00000}$ when the store pulse is generated at the end of phase 5 instead of up-dating the contents of the storage register. The up-range clock pulse to Z36 (pin 5) is logically controlled by Z48-8. Up-range is inhibited

when counter is on $\overline{R4}$ (DC + AC) or $\overline{R5}$ (KΩ) by logic zero on Z48-9, or $\overline{WAIT}$ is a logic zero on Z48-11. $\overline{WAIT}$ is triggered for each up- or down range command in the auto mode. The up-range clock pulse is gated to Z48-10 through Z40-6 and Z41-11, and is enabled by $\overline{12XXXX}$ • AUTO • $\overline{IN\text{-}RANGE}$ (Z30-11) a logic zero.

The down range clock pulse to Z36 (pin 4) is logically controlled by Z48-12. Down range is inhibited when counter is on $\overline{R0}$= (DC) or $\overline{R1}$, other functions by a logic zero on Z48-1, or $\overline{WAIT}$ on Z48-13. The down-range clock pulse is gated to Z48-2 through Z40-12 and Z51-11, and is enabled by $\overline{<0000}$ • $\overline{AUTO}$ • $\overline{IN\text{-}RANGE}$ (Z30-8) a logic zero.

CONTROL CIRCUITRY

The five phases of the measurement cycle are controlled by the JK flip-flops identified as SEQ1, SEQ2, and SEQ3, which are Z62A, Z62B, and Z54B. The following truth table identifies the state of the control flip-flops for a specific phase of the measurement cycle:

SEQ1	SEQ2	SEQ3	
0	0	0	REST
1	0	0	PHASE 1 and PHASE 2
1	1	0	PHASE 3
1	1	1	PHASE 4
0	1	1	PHASE 5
0	0	1	STORE
0	0	0	REST

The initial condition exists between measurement cycles, and the flip-flops are triggered to that state at the end of the store pulse from the previous reading. The states of these are decoded by NAND-gates and provide the control signals for the analog switches of the analog circuit board. The control register is set to 100 by the START signal through the direct coupled set and reset inputs to the flip-flops. The state 110 is triggered by ZERO • 8K through Z61-3 to Z62-6. The state 111 is triggered by DAC • $\overline{LOAD\ 11}$ • STOP or E.O.D. (end of DAC), as defined when the count in the most significant decade is zero, through Z41-8 to Z54-6. State 011 is triggered by 8K to Z62-1. State 001 is triggered by Z61-6 to Z62-6. State 000 is triggered by the store command through Z39-4 to Z41-9 to Z54-6.

The output signal lines are decoded by NAND-gates and provide the control signals to the analog board.

$\overline{ZERO\ SW} = \overline{SEQ1} \bullet \overline{SEQ3} + SEQ1 \bullet \overline{SEQ2} \bullet \overline{8K} = Z59\text{-}8$

ZERO = SEQ1 • $\overline{SEQ2}$ = Z59-6

DAC = SEQ2 • $\overline{SEQ3}$ = Z59-3

$\overline{EX}$ = SEQ1 • SEQ3 = Z60-3

$\overline{ER}$ = $\overline{SEQ1}$ • SEQ2 = Z60-6

POWER SUPPLY (Drawing 200431)

The power supply block may be connected to either a 115 or 230 volt AC power source. The block is essentially two separate sets of supplies, driven from the same power transformer. The inside power supplies are triple shielded, floating, and guarded for isolation. The outside +9V power supply consists of a raw DC that is used to power the electrical output option when it is installed in the instrument.

The inside power supply develops ±20V regulated supply voltage for the analog circuitry, the +200V for the Sperry readout, and the +5V regulated voltage for the digital circuitry.

The regulators are designed using monolithic voltage regulators and series-pass discrete transistors and are short-circuit proof. The +5V regulator includes an overvoltage crowbar circuit to protect the integrated circuits.

The +5V regulator consists of VR1 and pass transistor Q1. The output voltage is determined by FSV resistor R2. Overvoltage is detected by Zener diode CR6, which turns on the crowbar SCR, CR7.

The −20V regulator consists of VR3, pass transistor Q4 and current limiting transistor Q3. The −20V output voltage is determined by FSV resistor R18.

The +20V regulator consists of VR2 and pass transistor Q2. The output voltage is referenced to the −20 volt regulator and is determined by FSV R13.

The power supply board provides the interconnection between the analog and digital circuit boards.

DATA OUTPUT (Drawing 200436)

The data output/remote programming option includes the circuitry required to provide isolated BCD data or isolated remote programming.

Data Output Connector
1 ea 50-pin Amphenol 57-40500

Remote Control Connector
1 ea 50-pin Amphenol 57-40500

Mating Connectors (supplied)
2 ea 50-pin Amphenol 57-30500

OPERATION

To command a function or range, apply a contact closure, or a 0V logic level between the appropriate "FUNCTION" or "RANGE" pin and the "COMMON" (pin 13) of the remote programming connector, (Table 5-1). Unit will autorange when manual range is not programmed.

The circuitry is designed to interface directly with DTL, TTL, (open collector), discrete NPN transistors, or contact closures. The transistors should be capable of sinking 15 milliamperes and withstanding 5V collector-to-emitter when it is not commanding a function.

ISOLATION

The remote programming unit is electrically isolated from the analog input common. The analog common may be ±500 VDC or peak AC from the chassis.

PROGRAMMING

The following truth table illustrates the acceptable simultaneous combinations of input commands and the results of incompatible functions:

	$\overline{R0}$	$\overline{R1}$	$\overline{R2}$	$\overline{R3}$	$\overline{R4}$	$\overline{R5}$
$\overline{VDC}$	100MV	1V	10V	100V	1000V	1000V
$\overline{EXT\ REF}$	100MV	1V	10V	100V	1000V	1000V
$\overline{VAC}$	1V	1V	10V	100V	1000V	1000V
$\overline{K\Omega}$	100Ω	1KΩ	10K	100K	1000K	10,000K

NOTE:

1. Unit is in autorange in absence of range command.
2. VDC is selected when EXT REF is commanded.
3. Unit is in DC in absence of function command.

The unit will initiate a measurement cycle from a remote command when the front EXT TRIG pushbutton is depressed. The EXT TRIG control line (pin 39) will trigger the unit on a low-going change of state.

DATA OUTPUT

The BCD data of the DMM 50 is available at the output connector completely in parallel or in a serial character, parallel bit format. The parallel bit acquisition technique provides a means of transferring all data over four wires, with additional wires required to control the serialization of the data.

Figure 5-7 presents BCD data interface pin connections and illustrates the functional grouping of the data lines. The inhibit lines are only associated with serial characters, parallel bit data acquisition, and no connections are required to these lines for parallel data acquisition.

The parallel data BCD 8-4-2-1 (DCBA) outputs all measurement data plus flag lines for DATA READY and OVERLOAD (10^5).

PARALLEL DATA ACQUISITION

NOTE:

Leave INHIBIT lines on pins 3, 7, 28, 32, 36, 39, 42, 45, and 49 open. i.e., no connections to these lines.

The following truth table illustrates the output BCD (positive true) code for the functions:

Table 5-1. Remote Programming, Connector Pin Assignments to J1

PIN NO.	FUNCTION	PIN NO.	FUNCTION
1	SPARE	26	SPARE
2	SPARE	27	SPARE
3	SPARE	28	SPARE
4	SPARE	29	SPARE
5	SPARE	30	SPARE
6	SPARE	31	SPARE
7	SPARE	32	SPARE
8	SPARE	33	SPARE
9	SPARE	34	SPARE
10	$\overline{R1}$	35	$\overline{R0}$
11	$\overline{R3}$	36	$\overline{R2}$
12	$\overline{R4}$	37	$\overline{R5}$
13	SPARE	38	$\overline{\text{DATA READY}}$
14	$\overline{K\Omega}$	39	$\overline{\text{EXT TRIGGER}}$
15	$\overline{AC}$	40	$\overline{DC \cdot AC}$
16	$\overline{\text{EXT REF}}$	41	$\overline{FTL}$
17	SPARE	42	SPARE
18	SPARE	43	SPARE
19	SPARE	44	SPARE
20	SPARE	45	SPARE
21	SPARE	46	SPARE
22	SPARE	47	SPARE
23	SPARE	48	SPARE
24	SPARE	49	SPARE
25	SPARE	50	SPARE

INTERFACE INFORMATION

DEFINITIONS:

RESPONSE TIME:

This term is synonymous with digitizing time and includes all internal DMM time-outs for polarity and range changes. The response time internal is between the "falling" External Trigger Command and the "falling" Data Ready response of the DMM. See Figure 1.

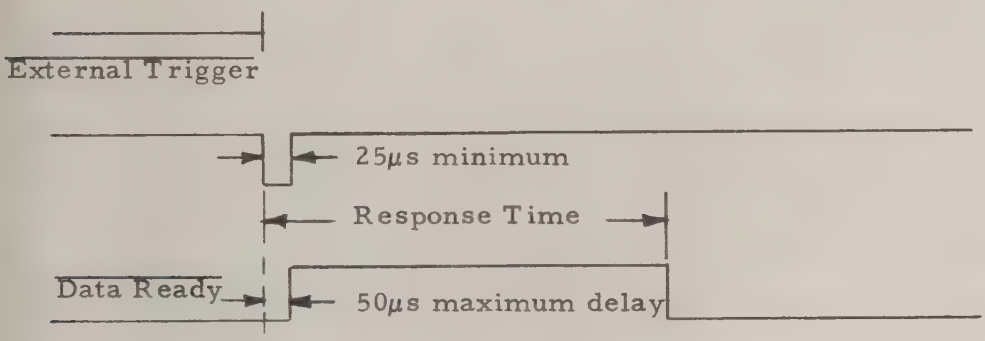


FIGURE 1
Response Time For a Steady State Input

SETTLING TIME

Settling time is the time needed for the DMM input circuitry to stabilize to the signal to be measured. The settling time internal must be from the time a function or input signal step change is made to the "falling" edge of the External Trigger Command. See Figure 2.

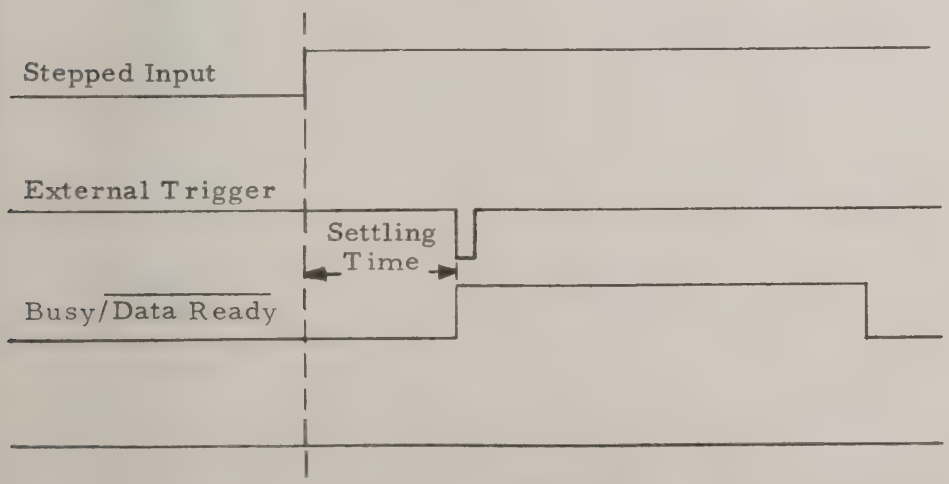


FIGURE 2
Settling Time From a Step Input Change

	W/O Filter			W Filter		
	C	B	A	C	B	A
DCV	0	0	0	1	0	0
EXT REF	0	0	1	1	0	1
K	0	1	0	1	1	0
AC	0	1	1	1	1	1

The following truth table illustrates the output BCD (positive true) code for the range information:

DC	AC	KΩ	C	B	A
100MV	NA	100Ω	0	0	0
1V	1V	1K	0	0	1
10V	10V	10K	0	1	0
100V	100V	100K	0	1	1
1000V	1000V	1,000K	1	0	0
NA	NA	10,000K	1	0	1

The polarity output data on pin J2-27 is high (logic "1") for positive polarity and is low (logic "0") for negative polarity.

The following truth table illustrates the output BCD (positive true) code for the magnitude data information:

	8	4	2	1
DECIMAL	D	C	B	A
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1

OVERLOAD (OVERSCALE)

The overload data line (J2-25) indicates when the measurement is overscale. Normally the data line is low (logic "0"), and goes high (logic "1") when an overload or an overscale condition exists.

READY

The ready or busy data flag indicates when the measurement cycle is in progress or busy by a high (logic "1") level on J2-50. The low-going transition to a low (logic "0") logic level indicates measurement is completed and can be utilized as a $\overline{\text{PRINT COMMAND}}$.

SERIAL CHARACTER DATA ACQUISITION

Refer to pin connection Figure 5-7 and connect the data blocks in parallel; i.e., connect all A's, B's, C's, and D's together so that output data can be presented on four output lines.

The user-supplied clock controls the INHIBIT lines to determine the sequence of character acquisition. Only one INHIBIT line can be high at a time. Valid data is transferred from the data block whose INHIBIT line is high. The data is presented to the four output lines in serial-character, parallel 8-4-2-1 code.

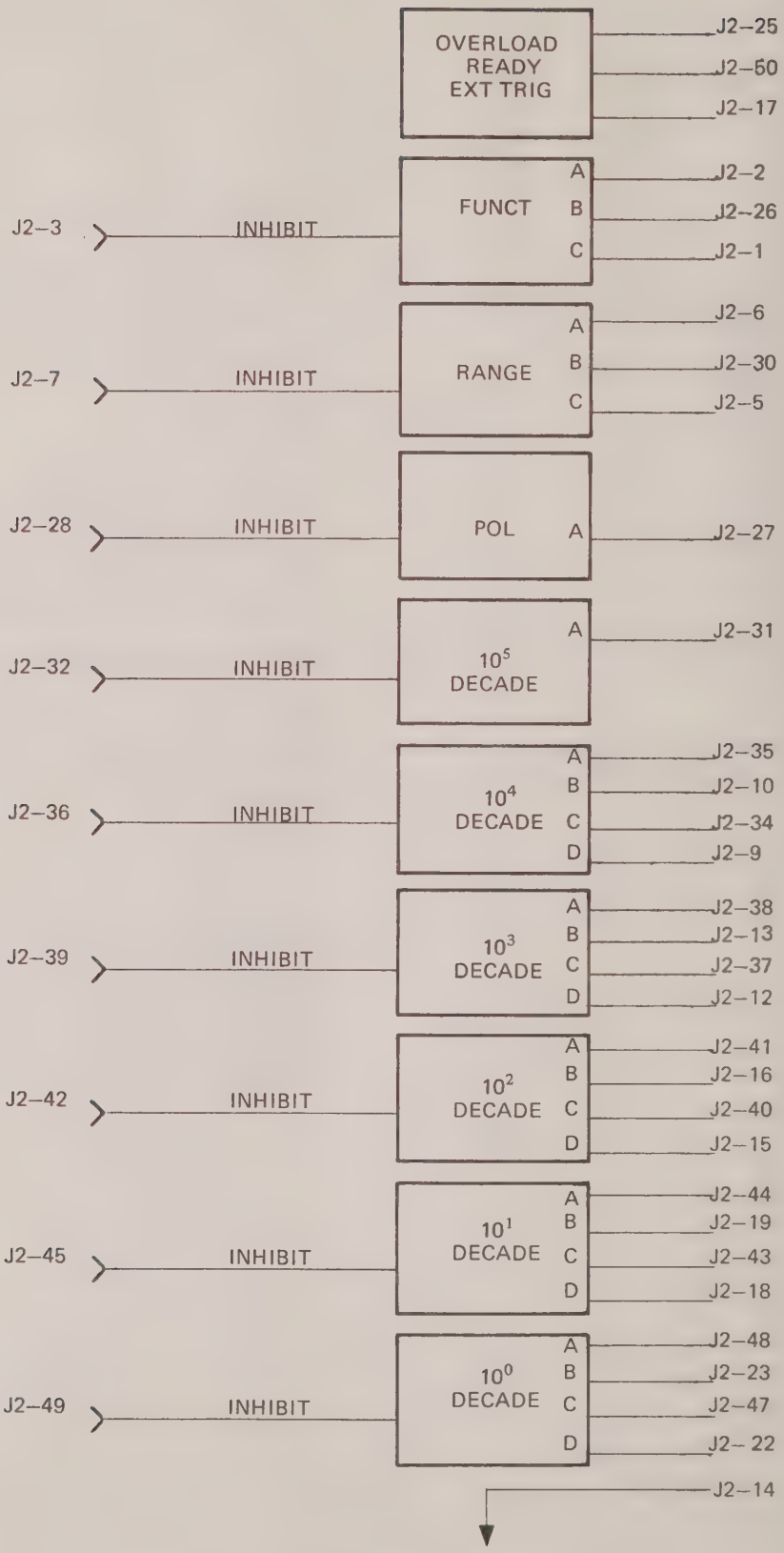


Figure 5-7. Data Output Pin Connections (J2)

SECTION VI
MAINTENANCE

GENERAL MAINTENANCE

Section VI contains troubleshooting information, parts lists, parts location diagrams and schematic diagrams to aid in maintaining and calibrating the DMM 50.

TROUBLESHOOTING AND REPAIR

When a set of spare sub-assemblies are available, troubleshooting the instrument is simplified.

Without the aid of a spare set of boards, the first step is to determine the bad sub-assembly.

1. Power Supply

Monitor the power supply voltages:

Test Point	Voltage
+20	+19.8 ±.2 VDC
-20	-19.8 ±.2 VDC
+5	+4.8 ±.1 VDC
+200	+185 ±15 VDC

When a voltage is low, determine whether a power supply failure has occurred or if the supply is forced into current limiting by an excessive current drain. The current demand from each supply may be determined by monitoring the voltage across the corresponding current programming resistor. This voltage must be less than .6 VDC to insure limiting does not occur.

Supply	Resistor	Voltage
+5	R5	<.6 VDC
+20	R10	<.6 VDC
-20	R21	<.6 VDC

2. Digital

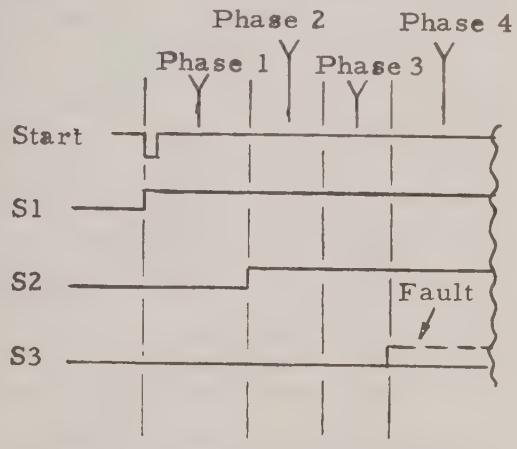
Latch-up

The DMM 50 is a closed loop instrument. A condition known as latch-up will exist if a cycle fault has occurred during the measurement cycle. The instrument will be temporarily un-latched if resistor A3R44 is removed from the circuit. This will allow start pulses to be gated through A3Z61 from the sample rate generator. Always resolder A3R44 when the cause of the latch-up has been found.

The DMM 50 uses three flip-flops for phase control during the computational cycle – A3S1, S2 and S3.

When troubleshooting a cycle fault, use figure 5-5 (DMM 50 timing chart). Check the states of the three phase flip-flops to determine the phase during which the fault occurs and the missing logic to get to the next phase.

Example: A check on the phase flip-flops shows:



The timing relationship of the phase flip-flops shows that a fault occurs during phase 3 that does not allow progression to phase 4. A check of the digital schematic shows that in order to set S3, at the end of phase 3, Z54-9 must be high and Z54-6 must have a clock pulse at the end of phase 3. Z41-9 must be low allowing the E.O.D. pulse to be gated through Z41-10 at the end of phase 3.

Lock-up

When an apparent latch-up condition exists but lifting resistor A3R44 does not start the instrument (indicated by the lack of movement of the display indication) a lock-up condition exists. This

condition is generally caused by the lack of a STOP pulse, from A3Z34-10, at the end of ER time.

3. Analog

Input Amplifier

The input amplifier consists of A6AR1, AR2 and associated switches and gain attenuator circuitry.

The input stage is a precision high-gain, switched amplifier. When troubleshooting this portion of the instrument, it is usually desirable to lock the amplifier in either of its two switched condition, EO and $\overline{EO}$. By depressing the front panel EXT/TRIG push button, the amplifier is forced into its EO condition, – input connected to signal common by A6Q5. During this steady state condition, the voltage at (TP4) represents the zero off-set voltage of input amplifier (V_{EO}). This voltage (V_{EO}) should be less than ±1.5 VDC ($|V_{EO}|<1$).

The other switched condition of the input amp ($\overline{EO}$) may be held at steady-state by grounding the collector of A6Q25. The voltage at TP4 ($V_{\overline{EO}}$) is now a function of the DC input to the DMM (V). V is the alyelraic difference of $V_{\overline{EO}}$ and V_{EO} (ex: $V = V_{\overline{EO}} - V_{EO}$).

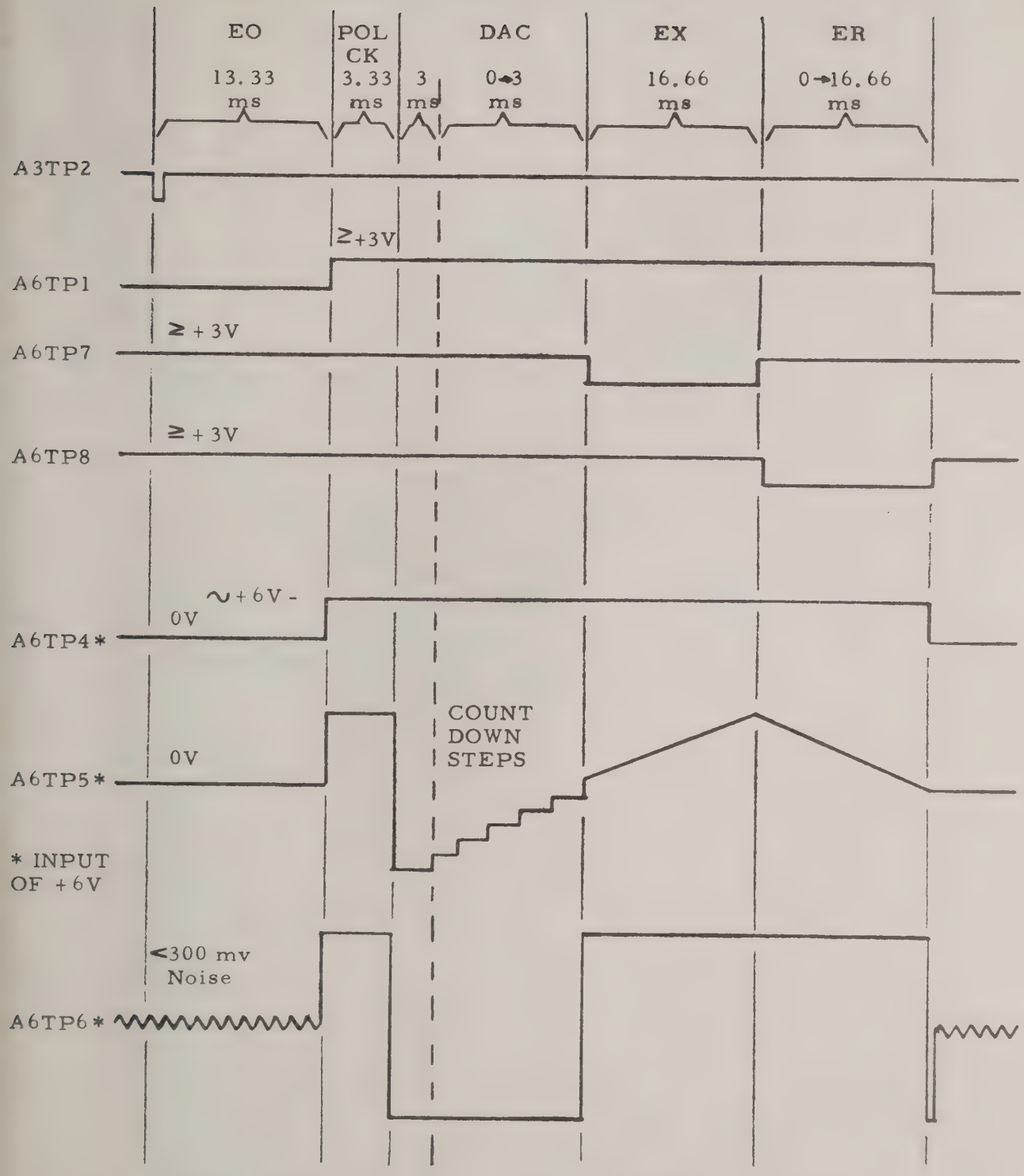
The following table shows examples demonstrating the relationship of V, $V_{\overline{EO}}$ and V_{EO}.

V	$V_{\overline{EO}}$	V_{EO}	DMM Digital Readout
+10.0000	+9.9850	-.0150	+10.0000
+9.0000	8.9850	-.0510	+9.0000
-10.0000	-10.0150	-.0150	-10.0000
-9.0000	-9.0150	-.0150	-9.0000

To check the input switch (Q3 and Q5) drive signals remove the short on the collector of Q25 and be sure the EXT/TRIG push button is not engaged. Synch an oscilloscope to A3TP1 (Digital Board) while observing the waveform at the gate of A6Q5. This waveform should represent EO logic with a high level of approximately +.5 VDC and a low level of approximately -19 VDC. The waveform at the gate of A6Q3 should correspond to the logic $\overline{EO}$ with a high level equal to the DMM DC INPUT SIGNAL (Red and black input jacks). The low level should be approximately -19 VDC.

Integrator and Comparator

Refer to figure 6-1 for a list of test points on the analog board and typical oscilloscope presentations.

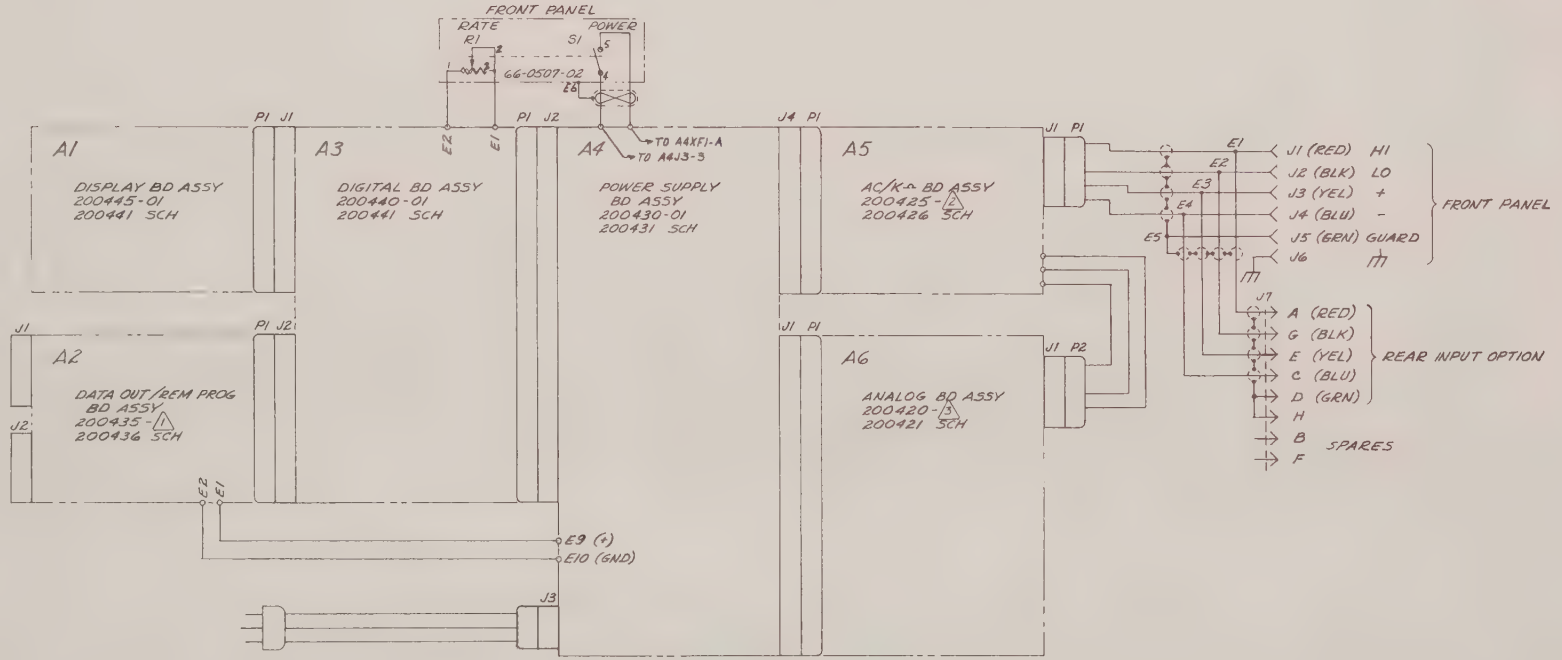


NOTE: INVERT TP5 AND TP6 FOR INPUT OF (-) POLARITY

FIGURE 6-1

TYPICAL TEST POINT WAVE FORMS

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	ADDED R1-S1 TERM. IDENT	7-12-73	
B	ADDED E6 (E.C.O. 732)		



NOTES: UNLESS OTHERWISE SPECIFIED

1. REF A2
   200435-01 DATA OUT/REM PROG BD ASSY
   200435-02 DATA OUT BD ASSY
2. REF A5
   200425-01 AC/K CONV BD ASSY
   200425-02 AC CONV BD ASSY
   200425-03 K CONV BD ASSY
3. REF A6
   200420-01 ANALOG BD ASSY WITH 100MV PREAMP
   200420-02 ANALOG BD ASSY
4. WHEN OPTION A5 IS NOT USED, P1 FROM FRONT PANEL MATES WITH A6J1.

LEAR SIEGLER INC | CIMRON DIVISION

SCHEMATIC - 5 DIGIT DIGITAL MULTIMETER

DRAWN 4-27-72 | CHECKED | ENGR APPROVED 9/1/72 | CUSTOMER APPROVAL | DMM50 | APPLICATION Rel. W. Thomas 9-7-72

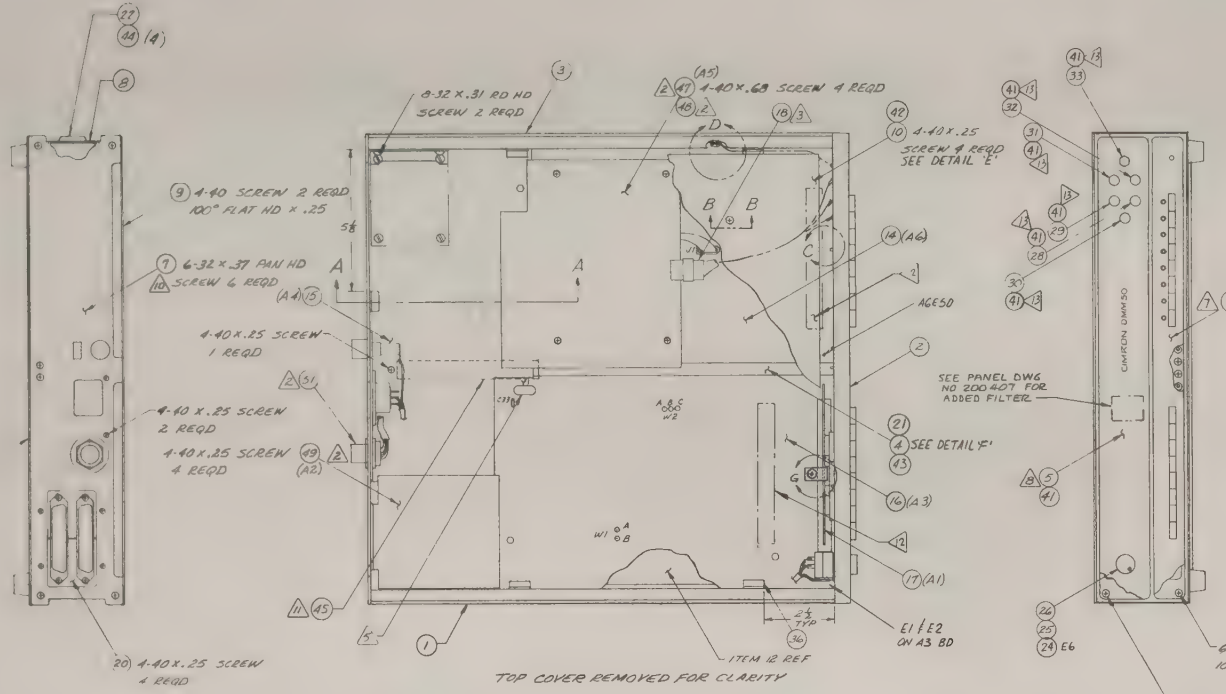
SIZE D | CODE IDENT NO. 15318 | DRAWING NO. 200401 | REV B

SCALE NONE | RELEASE | SHEET 1 OF 1

200401 B

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	INCORPORATED ADCN #1 & 2	10/24/72	
B	INCORPORATED ADCN #3 DELETE F/N 37 STOPS & REF THERETO	2-[illegible]-73	
C	GENERAL CLEAN-UP OF ADCN'S. 7-20-73	7/24/73	

/ SEE SHEET 1. FOR REVISIONS


8-32 X .31 RD HD SCREW 2 REQD
(A5) 4-40 X .63 SCREW 4 REQD
4-40 X .25 SCREW 4 REQD SEE DETAIL 'E'
4-40 SCREW 2 REQD 100° FLAT HD X .25
6-32 X .37 PAN HD SCREW 6 REQD
4-40 X .25 SCREW 1 REQD
4-40 X .25 SCREW 2 REQD
4-40 X .25 SCREW 4 REQD
ITEM 13 REF
SEE PANEL DWG NO 200407 FOR ADDED FILTER
SEE DETAIL 'F'
E1 & E2 ON A3 BD
ITEM 12 REF
20) 4-40 X .25 SCREW 4 REQD
CIMRON DMM50
6-32 SCREW 4 REQD 100° FLAT HD X .75
6-32 SCREW 2 REQD 100° FLAT HD X .38

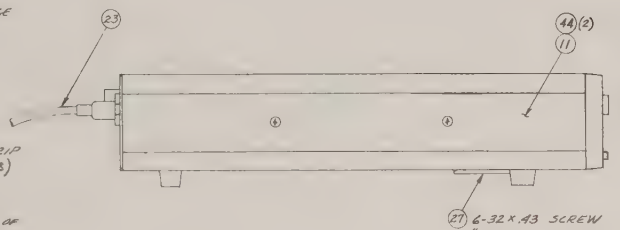
TOP COVER REMOVED FOR CLARITY

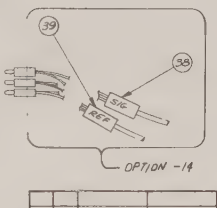
WIRING TABLE				
WIRE NO	FROM	TO	AWG-COLOR	REMARKS
1	J1	P1-1		ITEM 18 INTERNAL INPUT CABLE
2	J2	P1-3		
3	J3	P1-4		
4	J4	P1-5		
–	J5			
5	J6	GND LUG	24-GRN	GND LUG IS ON R.H. SIDE RAIL
6	J5	AGE50	24-GRN	
7	A4J3-3	R1-4	BLK	EXISTING 2-COND SHIELDED WIRE FROM 200430 ASSY.
–	A4XF1-A	R1-5	WHT	
–	SHIELD	TO E6		
8	R1-2	A3E1	24-WHT	SLEEVE WITH SHRINK
9	R1-1	A3E2	24-WHT	TUBING AT R1 END
10	R1-2	E1-3	24-BUSS	

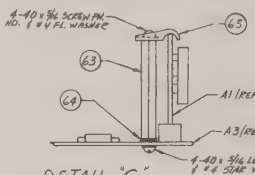
WIRING TABLE OPTION -07 & -08				
WIRE NO.	FROM	TO	AWG-COLOR	REMARKS
101	A2TB2A-E1	A4-E9	18 RED	EXISTING A2 WIRE
102	A2TB2A-E2	A4-E10	18 BLK	EXISTING A2 WIRE

NOTE: UNLESS OTHERWISE SPECIFIED

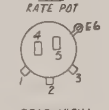
1. REF SCHEMATIC NO. 200401
2. OPTIONS: SEE OPTION TABLE ON SHT 2 FOR USAGE
3. WHEN ITEM 47 IS NOT INSTALLED, CABLE (ITEM 18) SHOULD TERMINATE AT AGJ1.
4. RACK MOUNTING BRACKET SUPPLIED SEPARATELY, HARDWARE NOT INCLUDED.
5. FOR 50 HZ OPERATION, REPLACE A3Y1 WITH ITEM 55 AND ADD ITEM 56 (A3C33).
6. STAKE IN PLACE WITH LOCK-TITE OR EQUIV.
7. CEMENT ITEM 6 TO ITEM 2 USING SCOTCH-GRIP CONTACT CEMENT 1357 ALL AROUND. (ITEM 43)
8. [illegible]
9. MOUNT ITEM 12 TO ITEM 4 USING ITEM 34.
10. PLACE EXTERNAL TOOTH LOCKWASHER UNDER HEAD OF ALL SCREWS IN REAR PANEL (REF ITEM 7).
11. BOND ITEM 45 TO CENTER RAIL USING CI ADHESIVE (LOCATE BETWEEN PWR. SUP BD. & CTR. RAIL) ONE PLACE
12. BOND ITEM 45 (FISH PAPER) TO GUARD SHIELD ITEM 12 TO INSULATE SHIELD FROM PUSHBUTTON SWITCHES. TYPICAL TWO PLACES.
13. BEND ITEM 41 SOLDER LUG 45° ∠ AFTER INSTALLING ON BANANA JACKS (TYP - 6 PLACES) SO THAT LUG DOES NOT TOUCH BEZEL.







DETAIL "G"



REAR VIEW

ITEM NO	QTY REQD	DESCRIPTION	SCHEM DES	CIMRON PN	MFR OR VENDOR PN	CODE OR SPEC NO

LIST OF MATERIAL

PART NO	QTY REQD	END ITEM	NEXT ASSEMBLY	USED ON
-01		DMM-50		

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON:
FRACTIONS ± 1/16 DECIMALS X .060 XX .030 XXX ± .010
ANGLES ± 2°
SURFACE FINISH √
MATERIAL
FINISH

CONTRACT NO.
DRAWN W. Turner 4/23/72
CHECKED
ENGINEER
APPROVED
APPROVED
CUSTOMER APPROVAL
RELEASE W. Turner 9-19-72

CIMRON

MULTIMETER-DIGITAL, 5 DIGIT (DMM50)

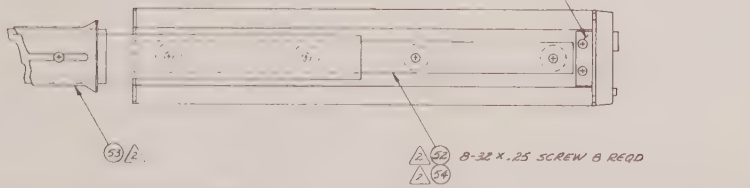
SIZE	CODE IDENT NO.	DRAWING NO.	REV
D	15318	200400	K

SCALE 1/2 & NOTED | DMM50 | SHEET 2 OF 5

200400

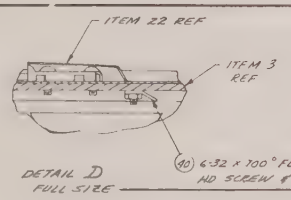
REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	SEE SHEET 1		

RACK SLIDE OPTION -06

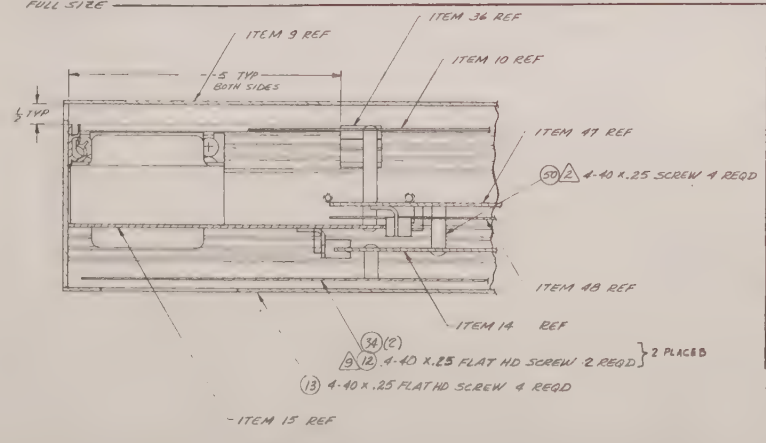


DETAIL C
TWICE SIZE

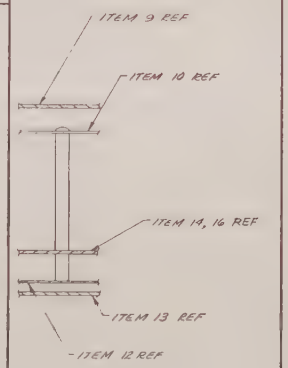
OPTION TABLE		
OPTION		
02	AC CONVERTER	ADD ITEM 47 (200425-02), 48 & 50. ASP2 MATES WITH AGJ1, ITEM 18 MATES WITH ASJ1.
03	K^{a} CONVERTER	ADD ITEM 47 (200425-03), 48 & 50. ASP2 MATES WITH AGJ1, ITEM 18 MATES WITH ASJ1.
04	AC/K^{a} CONVERTER	ADD ITEM 47 (200425-01), 48 & 50. ASP2 MATES WITH AGJ1, ITEM 18 MATES WITH ASJ1.
05	REAR INPUT	ADD ITEM 51. ROUTE THRU ITEM 36 MOUNTED ON SIDE RAIL ADJACENT TO ITEM 14/46.
06	RACK SLIDE	ADD ITEMS 19, 52, 53 & 54, REMOVE ITEMS 8, 11, 22 & 27
07	DATA OUT	ADD ITEM 49 (200435-04). REMOVE ITEM 20.
08	DATA OUT/REM PROG	ADD ITEM 49 (200435-03). REMOVE ITEM 20.
09	50 HZ OPERATION	SEE GENERAL NOTE 6 # PL 200454



DETAIL D
FULL SIZE


ITEM 9 REF
ITEM 36 REF
ITEM 10 REF
.5 TYP BOTH SIDES
.5 TYP
ITEM 47 REF
50 2 4-40 X .25 SCREW 4 REQD
ITEM 48 REF
ITEM 14 REF
34 12 9 4-40 X .25 FLAT HD SCREW 2 REQD } 2 PLACES
13 4-40 X .25 FLAT HD SCREW 4 REQD
ITEM 15 REF

SECTION A-A
FULL SIZE



SECTION B-B
TYP 3 PLACES
FULL SIZE

DETAIL 'F'
CARD GUIDE

CONTRACT NO		CIMRON DIVISION	
DRAWN		MULTIMETER - DIGITAL 5 DIGIT	
CHECKED			
ENGINEER			
APPROVED			
DMM 50	CUSTOMER APPROVAL	SIZE D	DODE IDENT NO 15318
USED ON APPLICATION		DRAWING NO 200400	REV H
		SCALE ½ (2:1) RELEASED DMM 50	SHEET 3 OF 5

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

EF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
	200400	5 DIGIT MULTIMETER	16067	--	
	200403-02	PANEL - SIDE L.H.	16067	1-10485	1
	200402-02	BEZEL - PANEL, FRONT	16067	1-10486	2
	200403-01	PANEL - SIDE R.H.	16067	1-10487	3
	200405-01	GUIDE - CARD	16067	2-10545	4
	200407-02	PANEL - FRONT, UPPER	16067	1-10488	5
	200408-01	PANEL - FRONT, LOWER	16067	1-10489	6
	200409-01	PANEL - REAR	16067	1-10490	7
	200410-01	PANEL - TRIM, SIDE R.H.	16067	1-10491	8
	200411-01	COVER - TOP	16067	1-10492	9
	200414-01	COVER - GUARD	16067	1-10493	10
	200410-02	PANEL - TRIM, SIDE L.H.	16067	1-10494	11
	200416-01	SHLD - GUARD BOTTOM	16067	1-10495	12
	200418-01	COVER - BOTTOM	16067	1-10496	13
A6	200420-01	ANALOG BOARD ASSY	16067		14
A4	200430-01	POWER SUPPLY BOARD	16067		15
A3	200440-01	DIGITAL BOARD ASSY	16067		16
A1	200445-01	DISPLAY BOARD ASSY	16067		17
	200423-01	INPUT CABLE	16067		18
	RACK MOUNTING	OPTION 15 - SEE ERA			19
	200453-01	COVER PLATE	16067	1-10497	20
	200405-02	INSULATOR	16067	2-10533	21
	184-5050 (BLK)	HANDLE BLACK	0000R	2-10504	22
	P-2392	POWER CORD	82389	2-50231	23
	761-3/8	SOLDER LUG	79963	2-50289	24
R1	66-0507-03	RATE POT, PWR SW	16067	5-70243	25
	70-2WD-2	KNOB	17227	2-10535	26
	MP40008-5	BAIL 15 1/2"	21604	2-10536	27
	2854 BLK	BANANA JACK BLK	05276	2-50277	28
	2854 RED	BANANA JACK RED	05276	2-50278	29
	1581 GRN	BANANA JACK GRN	05276	2-50279	30
	1581 YEL	BANANA JACK YEL	05276	2-50280	31
	1581 BLU	BANANA JACK BLU	05276	2-50281	32
	101	BANANA JACK GROUND	83330	2-50232	33
	N4-40-1/4 NYLON	SCREW, BINDER HD.	95987	2-10134	34
	MS171492	SPRING PIN 3/32 x 1/4	81349	2-10537	35

DEL	DMM 50	CALICO P/N 200400	ASSY R.D.
TLE	5 DIGIT MULTIMETER	SHT 4 OF 5	

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
	KKL-4	CLAMP	06915	2-10538	36
					37
	INPUT CALBE OPTION 14 - SEE ERA				38
	INPUT CABLE OPTION 14 - SEE ERA				39
	1412-6	TERM - GROUND #6	80112	2-50223-	40
	2101-14-00	SOLDER LUG, 1/4" HOLE	78189	2-50242	41
					42
	#1357	SCOTCH - GRIP CEMENT			43
	6-32 x 3/8 LG	SCREW, TRUSS HD			44
	5/8W x 5" LG	FISH PAPER .010 THK			45
					46
A5	AC/KΩ OPTION - SEE PL 200425				47
	AC/KΩ OPTION - SEE PL 200425				48
A2	BCD/PROG. OPTION - SEE PL 200435				49
	AC/KΩ OPTION - SEE PL 200425				50
	REAR INPUT OPTION - SEE PL 200424				51
	RACK SLIDE OPTION - SEE PL 200457				52
	RACK SLIDE OPTION - SEE PL 200457				53
	RACK SLIDE OPTION - SEE PL 200457				54
	50 Hz OPERATION - SEE PL 200454				55
	50 Hz OPERATION - SEE PL 200454				56
					57
					58
					59
					60
					61
					62
	8231-B-0440-3A	SPACER 1 3/4 LG	06540	2-10532	63
	2161	FIBER WASHER, #4 FLAT	83330	2-10087	64
	8966	CLAMP, CABLE, 1/4"	83330	2-10539	65
					66
					67
					68
					69
					70
					71

MODEL	CALICO P/N	ASSY R.D
DMM 50	200400	
TITLE 5 DIGIT MULTIMETER	SHT 5 OF 5	

A6 ASSEMBLY

ANALOG CIRCUITRY

REVISIONS					
SHT	ZONE	LTR	DESCRIPTION	DATE	APPROVED
1	6F	A	R190 WAS 1K, C5 WAS 7 PF IN PARALLEL WITH R11, DELETED C6 WAS 10 PF IN PARALLEL WITH R13.	11/27/71	
		B	GENERAL CLEAN-UP OF ADCN'S	7/1/72	
1&2		C	INCORP ECO 571 & 592,595	9/6/72	
1		D	INCORP. ECO 615	12/8/72	
1&2		E	REV. SER LTR ON ZONES 2,3,5,9,28,29,31,33 AND ADDED ZONE 4 BLANK ON ZONE 1	3/14/73	
1	2E	F	INC. ECO 653	6/1/74	
1&2		G	INC ECO 732	7/23/75	

NOTE: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE IN OHMS ±5%, .25W
2. ALL CAPACITORS ARE IN MICROFARADS
3. ALL DIODES ARE 1N4148
4. ALL FIELD EFFECT TRANSISTORS ARE 2N5246
5. ALL NPN TRANSISTORS ARE 2N4400
6. ALL PNP TRANSISTORS ARE 2N4402
7. SYMBOL ▽S DENOTES SIGNAL COMMON
8. SYMBOL ▽D DENOTES DIGITAL COMMON

⑨ SELECTED VALUE
10. R3 & R4 ARE A RESISTOR SET 200496-01
11. R106 THRU R114 ARE A RESISTOR SET 200497-01
12. ALL LAMPS ARE LIGHT EMITTING DIODES TIL209
13. PARTIAL REF DESIGNATIONS SHOWN, FOR COMPLETE DESIGNATOR, PREFIX WITH A6.

REF DESIGNATION		+5V	GND
Z1	SN7405N	14	7
Z2,4,6	SN7400N	14	7
Z3	SN7403N	14	7
Z5	SN7438N	14	7
AR2,	LM741HC	-	-
AR1	CIC230-2	-	-
AR4,5,6	7-96114	-	-
AR7	LM709CH	-	-
AR3	CIC230-3	-	-

REF	200420	200400
DASH NO.	NEXT ASSY	USED ON
	APPLICATION	

UNLESS OTHERWISE SPECIFIED DIM. IN INCHES TOLERANCES .X ±.1, .XX ±.03, .XXX ±.010, ANGLES ±0.5°, MACH. FIN. ▽

CONTR NO.
DR A.L. Lang 4-20-72
CHK
DSGN W. Thurston 9-26-72
ENGR G. Brito 9-26-72
PROJ
REL W. Thurston 9-26-72
APPD
APPD

SCHEMATIC- ANALOG BOARD ASSY A6

SIZE	CODE IDENT NO.	DWG NO.	LTR
E	98438	200421	G

SCALE NONE | DMM 50 | SHEET 1 OF 2

6-8

REVISIONS			
SHT	ZONE	LTR	DESCRIPTION	DATE	APPROVED
			SEE SHEET 1		

SEE SHEET 1
FOR MATING CONNECTOR
INFORMATION

SWITCH DRIVE A
SWITCH DRIVE B
+11V REF
-11V REF
BUFFER
11 BIT
2
2
2
2
2
2
1
FOL
+20V
-20V
+42V
+5V
TP1
PART OF P1
ZERO SW V
TP7
TP8
TP6
COMP ZERO
R88 4.1K
R89 4.7K
R90 47K
R91 10K
R92 330
R93 10K
R94 10K
R95 47K
R96 100K
R97 100K
R98 100K
R99 100K
R100 5K
R101 398.25K .1%
R102 100K .1%
R103 1M
R104 5K
R105 398.25K .1%
R106 100K .1%
R107 100K .1%
R108 200K
R109 200K
R110 200K
R111 200K
R112 200K
R113 200K
R114 4.02K/2
R115 36K
R116 4.7K
R117 4.7K
R118 47K
R119 100K
R120 3.3K
R121 10K
R122 1M
R123 100K
R124 100K
R125 398.25K .1%
R126 270K
R127 1M
R128 1K
R129 8.2K
R130 4.7K
R131 4.7K
R132 47K
R133 47K
R134 2.2K
R135 10K
R136 10K
R137 5M
R138 5M
R139 5K
R140 1M
R141 30K
R142 1M
R143 5.6K
R144 1K
R145 1K
R146 1K
R147 1K
R148 1K
R149 1K
R150 2.2K
R151 30K
R152 100
R153 1K
R154 1K
R155 10K
R156 1K
R157 100
R158 4.7K
R159 4.7K
R160 4.7K
R161 47K
R162 10K
R163 47K
R164 2.2K
R165 10K
R166 10K
R167 1.5M
R168 10K
R169 1M
R170 10K
R171 2K
R172 1M
R177 10K
R178 1M
C13 470 PF
C14 82 PF
C15 470 PF
C16 .0047
C17 30 PF
C18 15 PF
C19 15 PF
C20 30 PF
C21 47 PF
C22 .1
C23 .1
C24 .1
C25 .1
C26 .1
C27 1000 PF
C28 1000 PF
C29 .1
C30 .1
C31 .1
C32 .1
C33 30 PF
C38 15 PF
CR17 30A
CR18 30A
CR19
CR20
CR21
CR22
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CR24
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CR31
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CR38
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CR40
CR41 IN5736B
CR42 IN5736B
CR43 IN5736B
CR44 IN5736B
CR45 IN5736B
CR46 IN5736B
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Q42
Q43
Q44
Q45
Q46
Q47
Q48
AR6
AR7
Z4
Z6
Z6
Z6
E15
E16
E17
E18
E19
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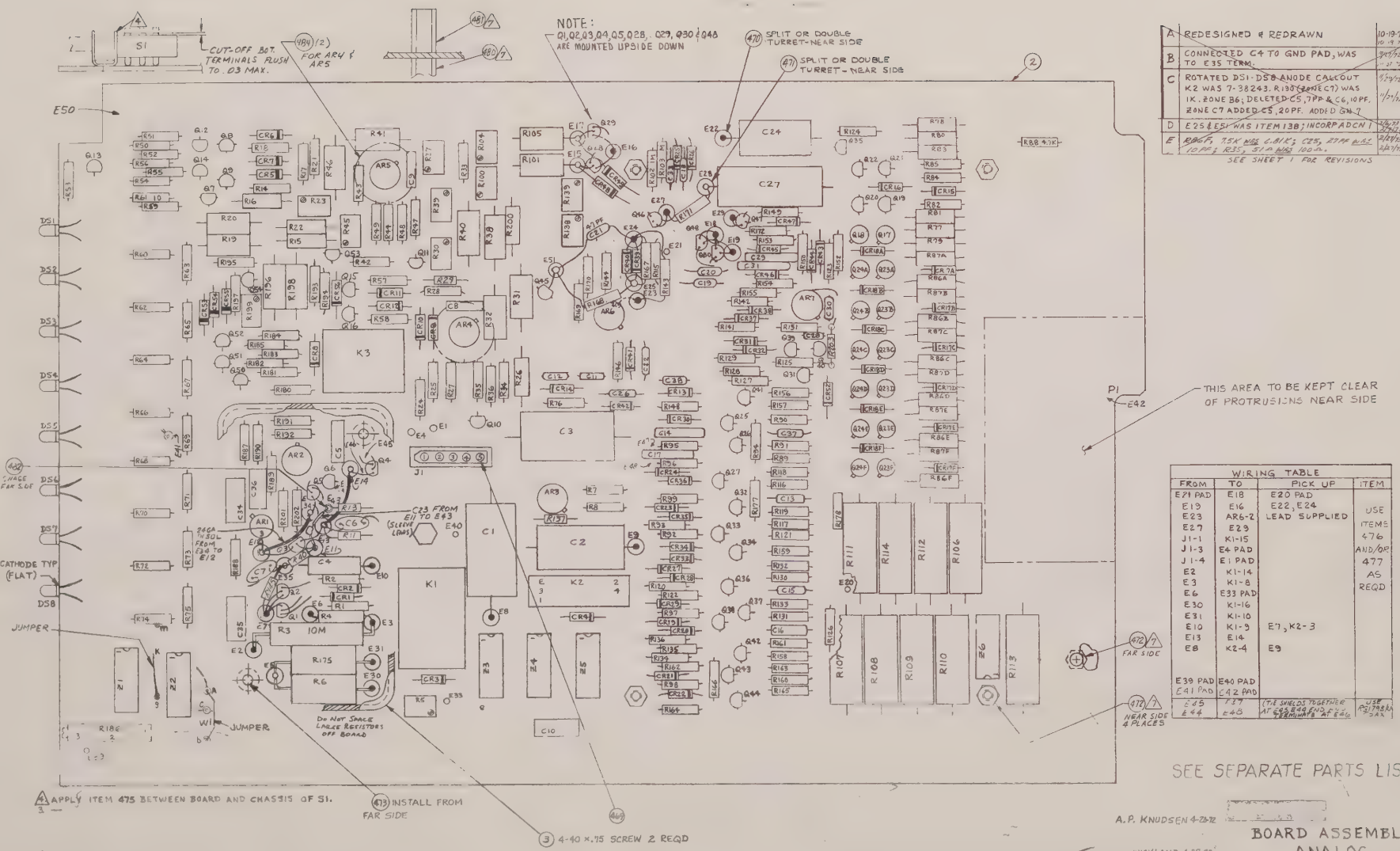
E21
E22
E23
E24
E25
E27
E28
E29
E47
E48
E51
E203

CODE IDENT NO	DWG NO.	LTR
E 28438	200421	G
NONE	DMM30	SHEET 2

200421 G



A	REDESIGNED & REDRAWN	10-19-72	G. Knudsen
B	CONNECTED C4 TO GND PAD, WAS TO E35 TERM.	3/17/72	W. Turner
C	ROTATED DS1-DS8 ANODE CALLOUT K2 WAS 7-38243. R130 (ZONE C7) WAS 1K. ZONE B6; DELETED C5, 7PF & C6, 10PF. ZONE C7 ADDED C5, 20PF. ADDED GN-7	11/27/72	W. Turner
D	E25 & E5 WAS ITEM 13B; INCORP ADCN 1	1/8/73	W. Turner
E	R86, 87, 7.5K NOT C.A.W.; C25, 27 AR NOT 10 PF; R35, 51 A NOT 100 Ω.	2/26/73	W. Turner

WIRING TABLE

FROM	TO	PICK UP	ITEM
E21 PAD	E18	E20 PAD	
E19	E16	E22, E24	USE
E23	AR6-2	LEAD SUPPLIED	ITEMS
E27	E29		476
J1-1	K1-15		AND/OR
J1-3	E4 PAD		477
J1-4	E1 PAD		AS
E2	K1-14		REQD
E3	K1-8		
E6	E33 PAD		
E30	K1-16		
E31	K1-10		
E10	K1-9	E7, K2-3	
E13	E14		
E8	K2-4	E9	
E39 PAD	E40 PAD		
E41 PAD	E42 PAD		
E45	E37	(TIE SHIELDS TOGETHER AT E45 & E40 END. TERMINATE AT E46)	USE RG178B/U-50Ω
E44	E46		

SEE SEPARATE PARTS LIST

A. P. KNUDSEN 4-26-72
J. WICKLAND 4-27-72
W. TURNER 5-16-72

BOARD ASSEMBLY-ANALOG A6

200420 N

DMM50 2 16

200420 N

(473) INSTALL FROM FAR SIDE

(3) 4-40 X .75 SCREW 2 REQD

(A) APPLY ITEM 475 BETWEEN BOARD AND CHASSIS OF S1.

3. —

2. —

1. REF. SCHEMATIC NO. 200421.

(A) SECURE IN PLACE WITH LOCTITE #242 (BLUE).

6. PARTIAL REF DESIGNATIONS SHOWN, FOR COMPLETE DESIGNATOR, PREFIX WITH A6.

5. LOCATE DS1-DS8 TO MATCH 200408-01 PANEL

-01 | 200400 DMM50

6-10

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A6	200420-01	ANALOG BOARD ASSY	16067		
					1
	200422-03	P.C. BOARD	16067	1-60214	2
	200444-01	SHIELD	16067	1-10475	3
					4
					5
					6
A6AR1	CIC 230-2	OPERATIONAL AMP (RED)	16067	3-60035	7
A6AR2	LM741HC	OPERATIONAL AMP	02335	3-60066	8
A6AR3	CIC 230-3	OPERATIONAL AMP (ORN)	16067	3-60036	9
A6AR4	CIC 235	OPERATIONAL AMP	16067	3-60083	10
A6AR5	CIC 235	OPERATIONAL AMP	16067	3-60083	11
A6AR6	CIC 230-3	OPERATIONAL AMP (ORN)	16067	3-60036	12
A6AR7	LM709CH	OPERATIONAL AMP	02335	3-60067	13
					14
					15
					16
					17
					18
A6C1	PDA7759	CAPACITOR .68μF 50V	12406	6-10957	19
A6C2	PD5A-334	CAPACITOR .33μF 50V	12406	6-10911	20
A6C3	PDA7759	CAPACITOR .68μF 50V	12406	6-10957	21
A6C4	SX210	CAPACITOR 1000PF 500V	90201	6-10910	22
A6C5	DM15-200J	CAPACITOR 20PF 500V	72136	6-10008	23
A6C6	DM15-200J	CAPACITOR 20PF 500V	72136	6-10008	24
A6C7	CM05F821J03	CAPACITOR 820PF 500V	81349	6-10050	25
A6C8	DM15-300J	CAPACITOR 30PF 500V	72136	6-10263	26
A6C9	DM15-300J	CAPACITOR 30PF 500V	72136	6-10263	27
A6C10	C280AE/A100K	CAPACITOR .1μF 10% 250V	73445	6-10916	28
A6C11	C280AE/A100K	CAPACITOR .1μF 10% 250V	73445	6-10916	29
A6C12	C280AE/A100K	CAPACITOR .1μF 10% 250V	73445	6-10916	30
A6C13	DM15-471J	CAPACITOR 470PF 500V	72136	6-10519	31
A6C14	DM15-820F	CAPACITOR 82PF 500V 1%	72136	6-10024	32
A6C15	DM15-471J	CAPACITOR 470PF 500V	72136	6-10519	33
A6C16	C280AE/A4K7	CAPACITOR .0047μF 10%	73445	6-10949	34

MODEL DMM 50 | CALICO P/N 200420 | ASSY R.D. A6

TITLE ANALOG BOARD ASSEMBLY | SHT 3 OF 16

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A6C17	DM15-300J	CAPACITOR 30PF 500V	72136	6-10263	35
A6C18	DM15-150J	CAPACITOR 15PF 500V	72136	6-10005	36
A6C19	DM15-300J	CAPACITOR 30PF 500V	72136	6-10263	37
A6C20	DM15-300J	CAPACITOR 30PF 500V	72136	6-10263	38
A6C21	DM15-470J	CAPACITOR 47PF 500V	72136	6-10268	39
A6C22	C280AE/A100K	CAPACITOR .1μF 10%	73445	6-10916	40
A6C23	CV10NP0109D	CAPACITOR 1pF 100V	80031	6-11008	41
A6C24	PD5A104K	CAPACITOR .1μF 20% 50V	12406	6-10958	42
A6C25	NOT USED				43
A6C26	C280AE/A100K	CAPACITOR .1μF 10%	73445	6-10916	44
A6C27	M1A-505	CAPACITOR 5μF 100V	12406	6-10959	45
A6C28	DM15-E102J	CAPACITOR 1000PF 100V	72136	6-10951	46
A6C29	C280AE/A100K	CAPACITOR .1μF 10%	73445	6-10916	47
A6C30	DM15-300J	CAPACITOR 30PF 500V	72136	6-10263	48
A6C31	C280AE/A100K	CAPACITOR .1μF 10%	73445	6-10916	49
A6C32	NOT USED				50
A6C33	DM15-150J	CAPACITOR 15PF 500V	72136	6-10005	51
A6C34	C280AE/A100K	CAPACITOR .1μF 10%	73445	6-10916	52
A6C35	C280AE/A100K	CAPACITOR .1μF 10%	73445	6-10916	53
A6C36	DM15-681J	CAPACITOR 680PF 300V	72136	6-10960	54
A6C37	DM15-E102J	CAPACITOR 1000PF 100V	72136	6-10951	55
A6C38	DM15-150J	CAPACITOR 15PF 500V	72136	6-10005	56
					57
					58
					59
					60
					61
					62
					63
					64
A6CR1	1N5739B	DIODE ZENER 13V	25403	3-10239	65
A6CR2	1N5739B	DIODE ZENER 13V	25403	3-10239	66
A6CR3	1N4148	DIODE	25403	3-10227	67
A6CR4	1N4148	DIODE	25403	3-10227	68
A6CR5	1N4148	DIODE	25403	3-10227	69
A6CR6	1N4148	DIODE	25403	3-10227	70

MODEL DMM 50 | CALICO P/N 200420 | ASSY R.D. A6

TITLE ANALOG BOARD ASSEMBLY | SHT 4 OF 16

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A6CR7	1N4148	DIODE	25403	3-10227	71
A6CR8	1N4148	DIODE	25403	3-10227	72
A6CR9	1N4148	DIODE	25403	3-10227	73
A6CR10	CIC 730-(GRN)	DIODE, REFERENCE SET	16067	3-10233	74
A6CR11	1N5740B	DIODE ZENER 15V	25403	3-10241	75
A6CR12	1N5740B	DIODE ZENER 15V	25403	3-10241	76
A6CR13	1N5729B	DIODE ZENER 5.1V	25403	3-10242	77
A6CR14	1N5729B	DIODE ZENER 5.1V	25403	3-10242	78
A6CR15	1N4148	DIODE	25403	3-10227	79
A6CR16	1N4148	DIODE	25403	3-10227	80
A6CR17A	1N4148	DIODE	25403	3-10227	81
A6CR17B	1N4148	DIODE	25403	3-10227	82
A6CR17C	1N4148	DIODE	25403	3-10227	83
A6CR17D	1N4148	DIODE	25403	3-10227	84
A6CR17E	1N4148	DIODE	25403	3-10227	85
A6CR17F	1N4148	DIODE	25403	3-10227	86
A6CR18A	1N4148	DIODE	25403	3-10227	87
A6CR18B	1N4148	DIODE	25403	3-10227	88
A6CR18C	1N4148	DIODE	25403	3-10227	89
A6CR18D	1N4148	DIODE	25403	3-10227	90
A6CR18E	1N4148	DIODE	25403	3-10227	91
A6CR18F	1N4148	DIODE	25403	3-10227	92
A6CR19	1N4148	DIODE	25403	3-10227	93
A6CR20	1N4148	DIODE	25403	3-10227	94
A6CR21	1N4148	DIODE	25403	3-10227	95
A6CR22	1N4148	DIODE	25403	3-10227	96
A6CR23	1N4148	DIODE	25403	3-10227	97
A6CR24	1N4148	DIODE	25403	3-10227	98
A5CR25	1N4148	DIODE	25403	3-10227	99
A6CR26	1N4148	DIODE	25403	3-10227	100
A6CR27	1N4148	DIODE	25403	3-10227	101
A6CR28	1N4148	DIODE	25403	3-10227	102
A6CR29	1N4148	DIODE	25403	3-10227	103
A6CR30	1N4148	DIODE	25403	3-10227	104
A6CR31	1N4148	DIODE	25403	3-10227	105
A6CR32	1N4148	DIODE	25403	3-10227	106

MODEL DMM 50 | CALICO P/N 200420 | ASSY R.D. A6

TITLE ANALOG BOARD ASSEMBLY | SHT 5 OF 16

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A6CR33	1N4148	DIODE	25403	3-10227	107
A6CR34	1N4148	DIODE	25403	3-10227	108
A6CR35	1N4148	DIODE	25403	3-10227	109
A6CR36	1N4148	DIODE	25403	3-10227	110
A6CR37	1N4148	DIODE	25403	3-10227	111
A6CR38	1N4148	DIODE	25403	3-10227	112
A6CR39	1N4148	DIODE	25403	3-10227	113
A6CR40	1N4148	DIODE	25403	3-10227	114
A6CR41	1N5736B	DIODE ZENER 10V	25403	3-10240	115
A6CR42	1N5736B	DIODE ZENER 10V	25403	3-10240	116
A6CR43	1N4148	DIODE	25403	3-10227	117
A6CR44	1N4148	DIODE	25403	3-10227	118
A6CR45	1N5736B	DIODE ZENER 10V	25403	3-10240	119
A6CR46	1N5736B	DIODE ZENER 10V	25403	3-10240	120
A6CR47	1N4148	DIODE	25403	3-10227	121
A6CR48	1N4148	DIODE	25403	3-10227	122
A6CR49	1N4148	DIODE	25403	3-10227	123
A6CR50	NOT USED				124
A6CR51	NOT USED				125
A6CR52	1N4148	DIODE	25403	3-10227	126
A6CR53	1N4148	DIODE	25403	3-10227	127
A6CR54	1N4148	DIODE	25403	3-10227	128
A6CR55	1N4148	DIODE	25403	3-10227	129
A6CR56	1N4148	DIODE	25403	3-10227	130
					131
					132
					133
					134
					135
					136
					137
					138
					139
					140
					141
					142

MODEL DMM 50 | CALICO P/N 200420 | ASSY R.D. A4

TITLE ANALOG BOARD ASSEMBLY | SHT 6 OF 16

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A6DS1	TIL 209	LAMP LED	01295	2-50225	143
A6DS2	TIL 209	LAMP LED	01295	2-50225	144
A6DS3	TIL 209	LAMP LED	01295	2-50225	145
A6DS4	TIL 209	LAMP LED	01295	2-50225	146
A6DS5	TIL 209	LAMP LED	01295	2-50225	147
A6DS6	TIL 209	LAMP LED	01295	2-50225	148
A6DS7	TIL 209	LAMP LED	01295	2-50225	149
A6DS8	TIL 209	LAMP LED	01295	2-50225	150
					151
					152
					153
A6J1	1625-5-R	CONN. RECEPTACLE	27264	4-10220	154
					155
					156
					157
A6K1	R10-E1-Z4-S110	RELAY 4 FORM C	24796	2-45133	158
A6K2	214-00003	RELAY REED	0000P	2-45126	159
A6K3	R10-E2-Z2-S200	RELAY 2 FORM C	24796	2-45129	160
					161
					162
					163
A6Q1	CIC 365-2	TRANSISTOR FET	16067	3-30245	164
A6Q2	CIC 365-2	TRANSISTOR FET	16067	3-30245	165
A6Q3	CIC 365-2	TRANSISTOR FET	16067	3-30245	166
A6Q4	CIC 365-2	TRANSISTOR FET	16067	3-30245	167
A6Q5	CIC 365-2	TRANSISTOR FET	16067	3-30245	168
A6Q6	CIC 365-2	TRANSISTOR FET	16067	3-30245	169
A6Q7	U1897	TRANSISTOR FET	15818	3-30260	170
A6Q8	2N5246	TRANSISTOR FET	0000L	3-30243	171
A6Q9	2N5246	TRANSISTOR FET	0000L	3-30243	172
A6Q10	2N4400	TRANSISTOR NPN	81349	3-30257	173
A6Q11	2N4402	TRANSISTOR PNP	81349	3-30259	174
A6Q12	2N4400	TRANSISTOR NPN	81349	3-30257	175
A6Q13	2N4402	TRANSISTOR PNP	81349	3-30259	176
A6Q14	2N4400	TRANSISTOR NPN	81349	3-30257	177
A6Q15	2N5246	TRANSISTOR FET		3-30243	178

MODEL DMM 50 | CALICO P/N 200420 | ASSY R.D. A6

TITLE ANALOG BOARD ASSEMBLY | SHT 7 OF 16

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A6Q16	2N5246	TRANSISTOR FET	0000L	3-30243	179
A6Q17	67-0512-1	TRANSISTOR PNP	16067	3-30262	180
A6Q18	67-0511-1	TRANSISTOR NPN	16067	3-30263	181
A6Q19	2N4400	TRANSISTOR NPN	81349	3-30257	182
A6Q20	2N4402	TRANSISTOR PNP	81349	3-30259	183
A6Q21	2N4402	TRANSISTOR PNP	81349	3-30259	184
A6Q22	2N4400	TRANSISTOR NPN	81349	3-30257	185
A6Q23A	67-0511-1	TRANSISTOR NPN	16067	3-30263	186
A6Q23B	67-0511-1	TRANSISTOR NPN	16067	3-30263	187
A6Q23C	67-0511-1	TRANSISTOR NPN	16067	3-30263	188
A6Q23D	67-0511-1	TRANSISTOR NPN	16067	3-30263	189
A6Q23E	67-0511-1	TRANSISTOR NPN	16067	3-30263	190
A6Q23F	67-0511-1	TRANSISTOR NPN	16067	3-30263	191
A6Q24A	67-0512-1	TRANSISTOR PNP	16067	3-30262	192
A6Q24B	67-0512-1	TRANSISTOR PNP	16067	3-30262	193
A6Q24C	67-0512-1	TRANSISTOR PNP	16067	3-30262	194
A6Q24D	67-0512-1	TRANSISTOR PNP	16067	3-30262	195
A6Q24E	67-0512-1	TRANSISTOR PNP	16067	3-30262	196
A6Q24F	67-0512-1	TRANSISTOR PNP	16067	3-30262	197
A6Q25	2N4400	TRANSISTOR NPN	81349	3-30257	198
A6Q26	2N4402	TRANSISTOR PNP	81349	3-30259	199
A6Q27	2N4400	TRANSISTOR NPN	81349	3-30257	200
A6Q28	2N5246	TRANSISTOR FET	0000L	3-30243	201
A6Q29	2N5246	TRANSISTOR FET	0000L	3-30243	202
A6Q30	U1897	TRANSISTOR FET	15818	3-30260	203
A6Q31	2N5246	TRANSISTOR FET	0000L	3-30243	204
A6Q32	2N4400	TRANSISTOR NPN	81349	3-30257	205
A6Q33	2N4402	TRANSISTOR PNP	81349	3-30259	206
A6Q34	2N4400	TRANSISTOR NPN	81349	3-30257	207
A6Q35	U1897	TRANSISTOR FET	15818	3-30260	208
A6Q36	2N4400	TRANSISTOR NPN	81349	3-30257	209
A6Q37	2N4402	TRANSISTOR PNP	81349	3-30259	210
A6Q38	2N4400	TRANSISTOR NPN	81349	3-30257	211
A6Q39	2N5246	TRANSISTOR FET	0000L	3-30243	212
A6Q40	2N5246	TRANSISTOR FET	0000L	3-30243	213
A6Q41	2N4202	TRANSISTOR PNP	81349	3-30259	214

MODEL DMM 50

CALICO P/N 200420

ASSY R.D. A6

TITLE ANALOG BOARD ASSEMBLY

SHT 8 OF 16

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A6Q42	2N4400	TRANSISTOR NPN	81349	3-30257	215
A6Q43	2N4402	TRANSISTOR PNP	81349	3-30259	216
A6Q44	2N4400	TRANSISTOR NPN	81349	3-30257	217
A6Q45	2N5246	TRANSISTOR FET	0000L	3-30243	218
A6Q46	2N5246	TRANSISTOR FET	0000L	3-30243	219
A6Q47	2N5246	TRANSISTOR FET	0000L	3-30243	220
A6Q48	U1897	TRANSISTOR FET	15818	3-30260	221
A6Q49	NOT USED				222
A6Q50	2N4400	TRANSISTOR NPN	81349	3-30257	223
A6Q51	2N4402	TRANSISTOR PNP	81349	3-30259	224
A6Q52	2N4400	TRANSISTOR NPN	81349	3-30257	225
A6Q53	U1897	TRANSISTOR FET	15818	3-30260	226
A6Q54	2N5246	TRANSISTOR FET	0000L	3-30243	227
					228
					229
					230
					231
					232
					233
					234
A6R1	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	235
A6R2	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	236
A6R3	200496-01	RESISTOR SET	16067	5-80349	237
A6R4	200496-01	RESISTOR SET	16067	5-80349	238
A6R5	3299W-1-201	POTENTIOMETER 200Ω	80294	5-70228	239
A6R6	RC42GF473J	RESISTOR 47K 5% 2W	81349	5-40030	240
A6R7	RC07GF513J	RESISTOR 51K 5% 1/4W	81349	5-10093	241
A6R8	RC07GF104J	RESISTOR 100K 5% 1/4W	81349	5-10100	242
A6R9		NOT USED			243
A6R10		NOT USED			244
A6R11	RC07GF105J	RESISTOR 1M 5% 1/4W	81349	5-10123	245
A6R12		NOT USED			246
A6R13	RC07GF105	RESISTOR 1M 5% 1/4W	81349	5-10123	247
A6R14	RC07GF105	RESISTOR 1M 5% 1/4W	81349	5-10123	248
A6R15	RN60D9091F	RESISTOR 9.09K 1% 1/4W	81349	5-60196	249
A6R16	RN60D1001F	RESISTOR 1K 1% 1/4W	81349	5-60020	250

MODEL DMM 50 | CALICO P/N 200420 | ASSY R.D. A6

TITLE ANALOG BOARD ASSEMBLY | SHT 9 OF 16

CALIFORNIA INSTRUMENTS CO. SAN DIEGO, CALIFORNIA	CODE IDENT 16067	PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A6R17	RC07GF105J	RESISTOR 1M 5% 1/4W	81349	5-10123	251
A6R18	RC07GF105J	RESISTOR 1M 5% 1/4W	81349	5-10123	252
A6R19	TYPE OB	RESISTOR 9K .05%	07088	5-80350	253
A6R20	TYPE OB	RESISTOR 1K .05%	07088	5-80338	254
A6R21	RC07GF105J	RESISTOR 1M 5% 1/4W	81349	5-10123	255
A6R22	RN60D3922F	RESISTOR 39.2K 1% 1/4W	81349	5-60669	256
A6R23	3299W-1-103	POTENTIOMETER 10K	80294	5-70208	257
A6R24	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	258
A6R25	RC07GF471J	RESISTOR 470Ω 5% 1/4W	81349	5-10045	259
A6R26	CIC 730 (RED)	RESISTOR REFERENCE 1%	16067	3-10233	260
A6R27	RC07GF202J	RESISTOR 2K 5% 1/4W	81349	5-10059	261
A6R28	RN55C1000F	RESISTOR 100Ω 1% 1/8W	81349	5-60684	262
A6R29	RN55C1472F	RESISTOR 14.7K 1% 1/8W	81349	5-60681	263
A6R30	3299W-1-203	POTENTIOMETER 20K	80294	5-70226	264
A6R31	CIC 730 (YEL)	RESISTOR REFERENCE .05%	16067	3-10233	265
A6R32	TYPE OB	RESISTOR 3.88K .05%	07088	5-80351	266
A6R33	RC07GF335J	RESISTOR 3.3M 5% 1/4W	81349	5-10129	267
A6R34	RC07GF151J	RESISTOR 150Ω 5% 1/4W	81349	5-10033	268
A6R35	RC07GF510J	RESISTOR 51Ω 5% 1/4W	81349	5-10022	269
A6R36	RC07GF472J	RESISTOR 4.7K 5% 1/4W	81349	5-10068	270
A6R37	3299W-1-103	POTENTIOMETER 10K	80294	5-70208	271
A6R38	TYPE OB	RESISTOR 14K .1%	07088	5-80352	272
A6R39	3299W-1-201	POTENTIOMETER 200Ω	80294	5-70228	273
A6R40	TYPE OB	RESISTOR 140K .1%	07088	5-80353	274
A6R41	TYPE OB	RESISTOR 4K .01%	07088	5-80354	275
A6R42	RC07GF202J	RESISTOR 2K 5% 1/4W	81349	5-10059	276
A6R43	RC07GF106J	RESISTOR 10M 5% 1/4W	81349	5-10135	277
A6R44	RC07GF515J	RESISTOR 5.1M 5% 1/4W	81349	5-10150	278
A6R45	3299W-1-103	POTENTIOMETER 10K	80294	5-70208	279
A6R46	TYPE OB	RESISTOR 4K .01%	07088	5-80354	280
A6R47	RC07GF472J	RESISTOR 4.7K 5% 1/4W	81349	5-10068	281
A6R48	RC07GF101J	RESISTOR 100Ω 5% 1/4W	81349	5-10029	282
A6R49	RC07GF151J	RESISTOR 150Ω 5% 1/4W	81349	5-10033	283
A6R50	RC07GF102J	RESISTOR 1K 5% 1/4W	81349	5-10053	284
A6R51	RC07GF102J	RESISTOR 1K 5% 1/4W	81349	5-10053	285
A6R52	RC07GF473J	RESISTOR 47K 5% 1/4W	81349	5-10092	286

MODEL DMM 50	CALICO P/N 200420		ASSY R.D. A6
TITLE ANALOG BOARD ASSEMBLY		SHT 10 OF 16	

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A6R53	RC07GF472J	RESISTOR 4.7K 5% 1/4W	81349	5-10068	287
A6R54	RC07GF473J	RESISTOR 47K 5% 1/4W	81349	5-10092	288
A6R55	RC07GF472J	RESISTOR 4.7K 5% 1/4W	81349	5-10068	289
A6R56	RC07GF473J	RESISTOR 47K 5% 1/4W	81349	5-10092	290
A6R57	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	291
A6R58	RC07GF102J	RESISTOR 1K 5% 1/4W	81349	5-10053	292
A6R59	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	293
A6R60	RC07GF271J	RESISTOR 270Ω 5% 1/4W	81349	5-10039	294
A6R61	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	295
A6R62	RC07GF271J	RESISTOR 270Ω 5% 1/4W	81349	5-10039	296
A6R63	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	297
A6R64	RC07GF271J	RESISTOR 270Ω 5% 1/4W	81349	5-10039	298
A6R65	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	299
A6R66	RC07GF271J	RESISTOR 270Ω 5% 1/4W	81349	5-10039	300
A6R67	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	301
A6R68	RC07GF271J	RESISTOR 270Ω 5% 1/4W	81349	5-10039	302
A6R69	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	303
A6R70	RC07GF271J	RESISTOR 270Ω 5% 1/4W	81349	5-10039	304
A6R71	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	305
A6R72	RC07GF271J	RESISTOR 270Ω 5% 1/4W	81349	5-10039	306
A6R73	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	307
A6R74	RC07GF271J	RESISTOR 270Ω 5% 1/4W	81349	5-10039	308
A6R75	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	309
A6R76	RC07GF472J	RESISTOR 4.7K 5% 1/4W	81349	5-10068	310
A6R77	RN60D2261F	RESISTOR 2.26K 1% 1/4W	81349	5-60073	311
A6R78	RN60D2212F	RESISTOR 22.1K 1% 1/4W	81349	5-60103	312
A6R79	RN60D1582F	RESISTOR 15.8K 1% 1/4W	81349	5-60074	313
A6R80	NC-5	RESISTOR 15.4K 1% 1/4W	07115	5-60679	314
A6R81	RN60D3162F	RESISTOR 31.6K 1% 1/4W	81349	5-60068	315
A6R82	RC07GF182J	RESISTOR 1.8K 5% 1/4W	81349	5-10058	316
A6R83	RN60D2212F	RESISTOR 22.1K 1% 1/4W	81349	5-60103	317
A6R84	RC07GF822J	RESISTOR 8.2K 5% 1/4W	81349	5-10074	318
A6R85	RC07GF153J	RESISTOR 15K 5% 1/4W	81349	5-10080	319
A6R86A	RN60D6811F	RESISTOR 6.81K 1% 1/4W	81349	5-60065	320
A6R86B	RN60D6811F	RESISTOR 6.81K 1% 1/4W	81349	5-60065	321
A6R86C	RN60D6811F	RESISTOR 6.81K 1% 1/4W	81349	5-60065	322

MODEL DMM 50 | CALICO P/N 200420 | ASSY R.D. A6

TITLE ANALOG BOARD ASSEMBLY | SHT 11 OF 16

CALIFORNIA INSTRUMENTS CO. SAN DIEGO, CALIFORNIA	CODE IDENT 16067	PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A6R86D	RN60D6811F	RESISTOR 6.81K 1% 1/4W	81349	5-60065	323
A6R86E	RN60D6811F	RESISTOR 6.81K 1% 1/4W	81349	5-60065	324
A6R86F	RN60D7501F	RESISTOR 7.5K 1% 1/4W	81349	5-60067	325
A6R87A	RN60D3922F	RESISTOR 39.2K 1% 1/4W	81349	5-60669	326
A6R87B	RN60D3922F	RESISTOR 39.2K 1% 1/4W	81349	5-60669	327
A6R87C	RN60D3922F	RESISTOR 39.2K 1% 1/4W	81349	5-60669	328
A6R87D	RN60D3922F	RESISTOR 39.2K 1% 1/4W	81349	5-60669	329
A6R87E	RN60D3922F	RESISTOR 39.2K 1% 1/4W	81349	5-60669	330
A6R87F	RN60D3922F	RESISTOR 39.2K 1% 1/4W	81349	5-60669	331
A6R88	RC07GF472J	RESISTOR 4.7K 5% 1/4W	81349	5-10068	332
A6R89	RC07GF472J	RESISTOR 4.7K 5% 1/4W	81349	5-10068	333
A6R90	RC07GF473J	RESISTOR 47K 5% 1/4W	81349	5-10092	334
A6R91	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	335
A6R92	RC07GF331J	RESISTOR 330Ω 5% 1/4W	81349	5-10041	336
A6R93	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	337
A6R94	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	338
A6R95	RC07GF473J	RESISTOR 47K 5% 1/4W	81349	5-10092	339
A6R96	RC07GF104J	RESISTOR 100K 5% 1/4W	81349	7-41267	340
A6R97	RC07GF104J	RESISTOR 100K 5% 1/4W	81349	7-41267	341
A6R98	RC07GF104J	RESISTOR 100K 5% 1/4W	81349	7-41267	342
A6R99	RC07GF104J	RESISTOR 100K 5% 1/4W	81349	7-41267	343
A6R100	3299W-1-502	POTENTIOMETER 5K	80294	5-70224	344
A6R101	TYPE OB	RESISTOR 398.25K .05%	07088	5-80355	345
A6R102	RC07GF105J	RESISTOR 1M 5% 1/4W	81349	5-10123	346
A6R103	RC07GF105J	RESISTOR 1M 5% 1/4W	81349	5-10123	347
A6R104	3299W-1-502	POTENTIOMETER 5K	80294	5-70224	348
A6R105	TYPE OB	RESISTOR 398.25K .05%	07088	5-80355	349
A6R106	200497-01 (R8)	RESISTOR SET (36.363K)	16067	5-80356	350
A6R107	200497-01 (R7)	RESISTOR SET (36.363K)	16067	5-80356	351
A6R108	200497-01 (R4)	RESISTOR SET (200K)	16067	5-80356	352
A6R109	200497-01 (R1)	RESISTOR SET (200K)	16067	5-80356	353
A6R110	200497-01 (R3)	RESISTOR SET (200K)	16067	5-80356	354
A6R111	200497-01 (R2)	RESISTOR SET (200K)	16067	5-80356	355
A6R112	200497-01 (R5)	RESISTOR SET (200K)	16067	5-80356	356
A6R113	200497-01 (R6B)	RESISTOR SET (400/2K)	16067	5-80356	357
A6R114	200497-01 (R6A)	RESISTOR SET (400/2K)	16067	5-80356	358

MODEL DMM 50	CALICO P/N 200420	ASSY R.D. A6
TITLE ANALOG BOARD ASSEMBLY	SHT 12 OF 16	

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A6R115	RC07GF363J	RESISTOR 36K 5% 1/4W	81349	5-10089	359
A6R116	RC07GF472J	RESISTOR 4.7K 5% 1/4W	81349	5-10068	360
A6R117	RC07GF472J	RESISTOR 4.7K 5% 1/4W	81349	5-10068	361
A6R118	RC07GF473J	RESISTOR 47K 5% 1/4W	81349	5-10092	362
A6R119	RC07GF104J	RESISTOR 100K 5% 1/4W	81349	5-10100	363
A6R120	RC07GF332J	RESISTOR 3.3K 5% 1/4W	81349	5-10064	364
A6R121	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	365
A6R122	RC07GF104J	RESISTOR 100K 5% 1/4W	81349	5-10100	366
A6R123	RC07GF104J	RESISTOR 100K 5% 1/4W	81349	5-10100	367
A6R124	RC07GF105J	RESISTOR 1M 5% 1/4W	81349	5-10123	368
A6R125	RC07GF105J	RESISTOR 1M 5% 1/4W	81349	5-10123	369
A6R126	RC07GF274J	RESISTOR 270K 5% 1/4W	81349	5-10110	370
A6R127	RC07GF133J	RESISTOR 13K 5% 1/4W	81349	5-10079	371
A6R128	RC07GF102J	RESISTOR 1K 5% 1/4W	81349	5-10053	372
A6R129	RC07GF822J	RESISTOR 8.2K 5% 1/4W	81349	5-10074	373
A6R130	RC07GF472J	RESISTOR 4.7K 5% 1/4W	81349	5-10068	374
A6R131	RC07GF472J	RESISTOR 4.7K 5% 1/4W	81349	5-10068	375
A6R132	RC07GF473J	RESISTOR 47K 5% 1/4W	81349	5-10092	376
A6R133	RC07GF473J	RESISTOR 47K 5% 1/4W	81349	5-10092	377
A6R134	RC07GF222J	RESISTOR 2.2K 5% 1/4W	81349	5-10060	378
A6R135	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	379
A6R136	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	380
A6R137	RC07GF510J	RESISTOR 51Ω 5% 1/4W	81349	5-10022	381
A6R138	3299W-1-502	POTENTIOMETER 5K	80294	5-70224	382
A6R139	3299W-1-502	POTENTIOMETER 5K	80294	5-70224	383
A6R140	RN55D2002F	RESISTOR 20K 1% 1/8W	81349	5-60577	384
A6R141	RC07GF105J	RESISTOR 1M 5% 1/4W	81349	5-10123	385
A6R142	RC07GF105J	RESISTOR 1M 5% 1/4W	81349	5-10123	386
A6R143	RC07GF562J	RESISTOR 5.6K 5% 1/4W	81349	5-10070	387
A6R144	RC07GF113J	RESISTOR 11K 5% 1/4W	81349	5-10077	388
A6R145	RN55D4022F	RESISTOR 40.2K 1% 1/8W	81349	5-60595	389
A6R146	RC07GF102J	RESISTOR 1K 5% 1/4W	81349	5-10053	390
A6R147	NOT USED				391
A6R148	RC07GF102J	RESISTOR 1K 5% 1/4W	81349	5-10053	392
A6R149	RC07GF102J	RESISTOR 1K 5% 1/4W	81349	5-10053	393
A6R150	RC07GF222J	RESISTOR 2.2K 5% 1/4W	81349	5-10060	394

MODEL DMM 50 | CALICO P/N 200420 | ASSY R.D. A6

TITLE ANALOG BOARD ASSEMBLY | SHT 13 OF 16

CALIFORNIA INSTRUMENTS CO. SAN DIEGO, CALIFORNIA	CODE IDENT 16067	PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A6R151	RC07GF303J	RESISTOR 30K 5% 1/4W	81349	5-10087	395
A6R152	RC07GF101J	RESISTOR 100Ω 5% 1/4W	81349	5-10029	396
A6R153	RC07GF102J	RESISTOR 1K 5% 1/4W	81349	5-10053	397
A6R154	RC07GF102J	RESISTOR 1K 5% 1/4W	81349	5-10053	398
A6R155	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	399
A6R156	RC07GF102J	RESISTOR 1K 5% 1/4W	81349	5-10053	400
A6R157	RC07GF101J	RESISTOR 100Ω 5% 1/4W	81349	5-10029	401
A6R158	RC07GF472J	RESISTOR 4.7K 5% 1/4W	81349	5-10068	402
A6R159	RC07GF472J	RESISTOR 4.7K 5% 1/4W	81349	5-10068	403
A6R160	RC07GF472J	RESISTOR 4.7K 5% 1/4W	81349	5-10068	404
A6R161	RC07GF473J	RESISTOR 47K 5% 1/4W	81349	5-10092	405
A6R162	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	406
A6R163	RC07GF473J	RESISTOR 47K 5% 1/4W	81349	5-10092	407
A6R164	RC07GF222J	RESISTOR 2.2K 5% 1/4W	81349	5-10060	408
A6R165	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	409
A6R166	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	410
A6R167	RC07GF155J	RESISTOR 1.5M 5% 1/4W	81349	5-10144	411
A6R168	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	412
A6R169	RC07GF105J	RESISTOR 1M 5% 1/4W	81349	5-10123	413
A6R170	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	414
A6R171	RC07GF202J	RESISTOR 2K 5% 1/4W	81349	5-10059	415
A6R172	RC07GF105J	RESISTOR 1M 5% 1/4W	81349	5-10123	416
A6R173	NOT USED				417
A6R174	NOT USED				418
A6R175	RC42GF473J	RESISTOR 47K 5% 2W	81349	5-40030	419
A6R176	NOT USED				420
A6R177	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	421
A6R178	RC07GF105J	RESISTOR 1M 5% 1/4W	81349	5-10123	422
A6R179	NOT USED				423
A6R180	RC07GF472J	RESISTOR 4.7K 5% 1/4W	81349	5-10068	424
A6R181	RC07GF473J	RESISTOR 47K 5% 1/4W	81349	5-10092	425
A6R182	RC07GF472J	RESISTOR 4.7K 5% 1/4W	81349	5-10068	426
A6R183	RC07GF223J	RESISTOR 22K 5% 1/4W	81349	5-10084	427
A6R184	RC07GF222J	RESISTOR 2.2K 5% 1/4W	81349	5-10060	428
A6R185	RC07GF473J	RESISTOR 47K 5% 1/4W	81349	5-10092	429
A6R186	3059Y-1-103	POTENTIOMETER 10K	80294	5-70242	430

MODEL	DMM 50	CALICO P/N 200420		ASSY R.D.
TITLE	ANALOG BOARD ASSEMBLY		SHT 14 OF 16	A6

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A6R187	RC07GF221J	RESISTOR 220Ω 5% 1/4W	81349	5-10037	431
A6R188	RC07GF221J	RESISTOR 220Ω 5% 1/4W	81349	5-10037	432
A6R189	RC07GF102J	RESISTOR 1K 5% 1/4W	81349	5-10053	433
A6R190	RC07GF562J	RESISTOR 5.6K 5% 1/4W	81349	5-10070	434
A6R191	RC07GF102J	RESISTOR 1K 5% 1/4W	81349	5-10053	435
A6R192	RC07GF183J	RESISTOR 18K 5% 1/4W	81349	5-10082	436
A6R193	RC07GF105J	RESISTOR 1M 5% 1/4W	81349	5-10123	437
A6R194	RC07GF620J	RESISTOR 62Ω 5% 1/4W	81349	5-10024	438
A6R195	RC07GF105J	RESISTOR 1M 5% 1/4W	81349	5-10123	439
A6R196	TYPE OB	RESISTOR 9K .05%	07088	5-80350	440
A6R197	RC07GF335J	RESISTOR 3.3M 5% 1/4W	81349	5-10129	441
A6R198	TYPE OB	RESISTOR 90.8Ω .05%	07088	5-80357	442
A6R199	3299W-1-103	POTENTIOMETER 10K	80294	5-70208	443
A6R200	CIC 730 (BLU)	RESISTOR REFERENCE 1%	16067	3-10233	444
A6R201	RC07GF205J	RESISTOR 2M 5% 1/4W	81349	5-10159	445
A6R202	RC07GF100J	RESISTOR 10Ω 5% 1/4W	81349	5-10005	446
A6R203	RC07 TBD	RESISTOR TBD			447
					448
					449
					450
					451
					452
					453
					454
					455
A6S1	8-64210-01	SWITCH PB 8 STA	16067	2-40455	456
					457
					458
A6Z1	SN7405N	I.C. INVERTER	01295	3-60017	459
A6Z2	SN7400N	I.C. GATE QUAD	01295	3-60000	460
A6Z3	SN7403N	I.C. GATE NAND	01295	3-60076	461
A6Z4	SN7400N	I.C. GATE QUAD	01295	3-60000	462
A6Z5	SN7438N	I.C. QUAD NAND	01295	3-60050	463
A6Z6	SN7400N	I.C. GATE QUAD	01295	3-60000	464
					465
					466

MODEL	CALICO P N	ASSY R.D.
DMM 50	200420	A6
TITLE	SHT OF	
ANALOG BOARD ASSEMBLY	15 16	

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
					467
					468
	1561	PIN TERM FEMALE	27264	4-10221	469
	FT-2-SM-1164SL	TERM. FEEDTHRU	98291	2-50227	470
	RST-2-SM-1160SL	TERM. STANDOFF	98291	2-50228	471
	2332	STANDOFF 1/4 HEX 1/2 LG	83330	2-10065	472
	S440-2	NUT CAPTIVE 4-40	46384	2-10522	473
					474
	#253	MYLAR TAPE .5 WIDE	99742		475
	22 GA				476
	3030	WIRE TEFLON 24 AWG	000AB		477
		MIL-W-16878D TYPE EE 1000V			478
					479
	8234-SS-0440-7	STANDOFF 1/4 HEX x $2\frac{1}{8}$	06540	2-10562	480
	9739-SS-0440-7	STANDOFF 1/4 HEX x 1/2	06540	2-10563	481
	2030B-1	TERMINAL, TURRET	88245	2-50157	482
					483
	TXBF-032-025B	HEATSINK	98978	2-40120	484
					485
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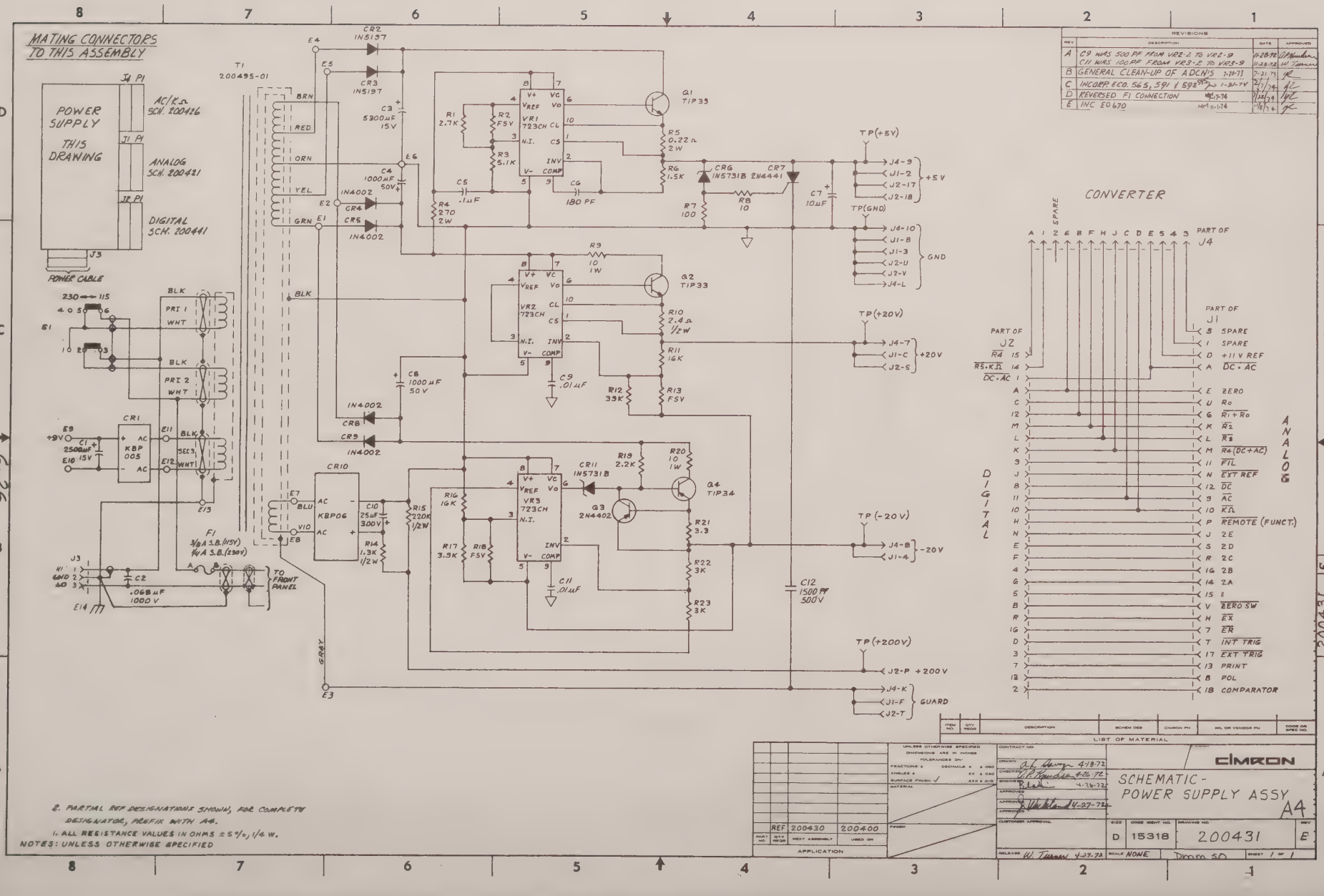
					502

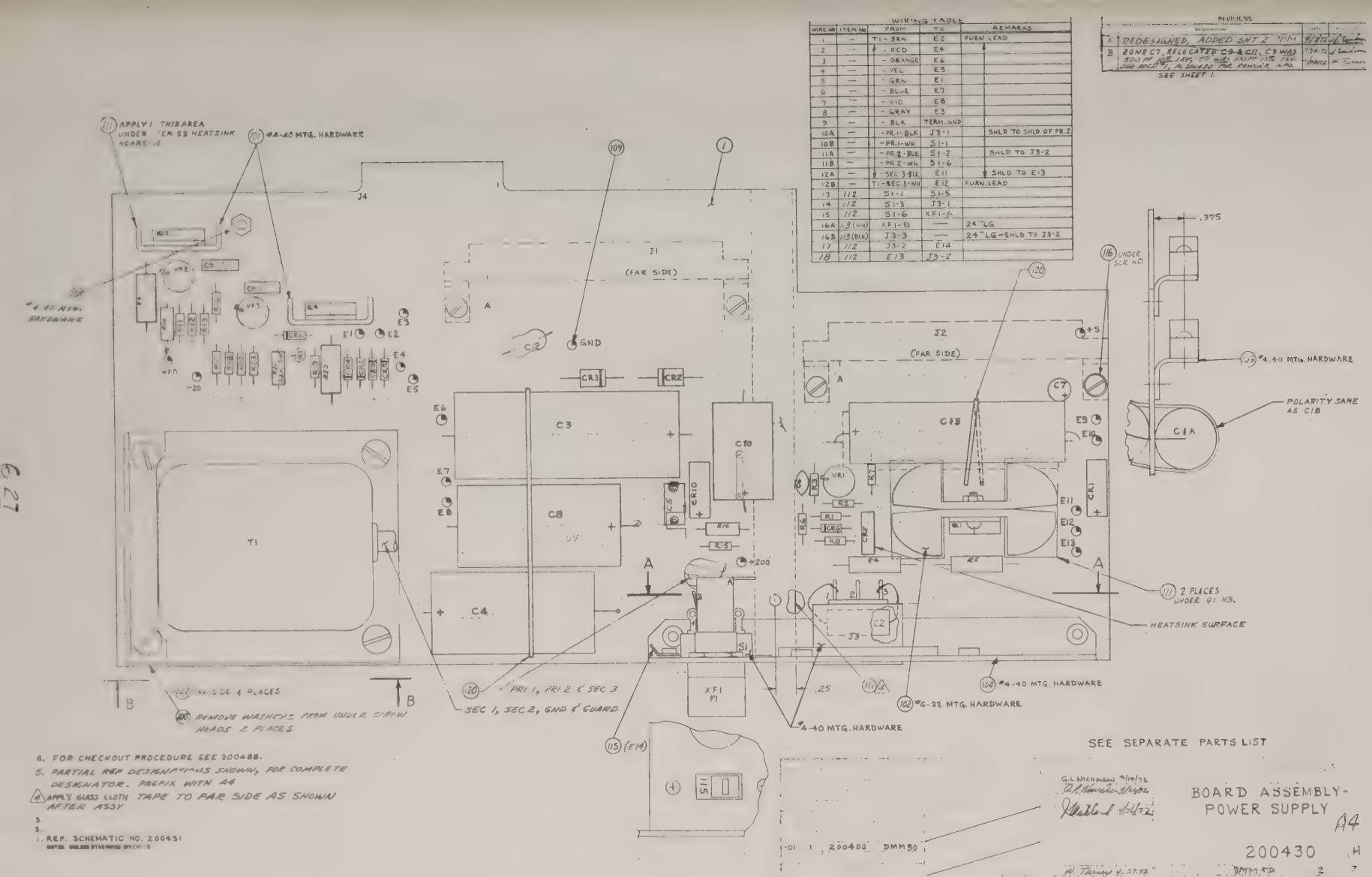
MODEL DMM 50 | CALICO P/N 200420 | ASSY R.D. A(

TITLE ANALOG BOARD ASSEMBLY | SHT 16 OF 16

A4 ASSEMBLY

POWER SUPPLY CIRCUITRY


MATING CONNECTORS TO THIS ASSEMBLY
POWER SUPPLY THIS DRAWING
J4 P1
AC/R SCH. 200426
J1 P1
ANALOG SCH. 200421
J2 P1
DIGITAL SCH. 200441
J3
POWER CABLE
T1 200495-01
BRN
RED
ORN
YEL
GRN
BLK
PRI 1 WHT
PRI 2 WHT
SEC 3 WHT
S1
CR1 KBP 005
C1 2500μF 15V
F1 3/4A S.B.(115V) 1/4A S.B.(230V)
C2 .068μF 1000V
TO FRONT PANEL
CR2 IN5197
CR3 IN5197
C3 5300μF 15V
C4 1000μF 50V
CR4 IN4002
CR5 IN4002
CR6 IN4002
CR7 IN4002
CR8 IN4002
CR9 IN4002
C8 1000μF 50V
CR10 KBP06
C10 25μF 300V
R14 1.3K 1/2W
R15 220K 1/2W
GRAY
Q1 TIP33
Q2 TIP33
Q3 2N4402
Q4 TIP34
VR1 723CH
VR2 723CH
VR3 723CH
R1 2.7K
R2 FSV
R3 5.1K
R4 270 2W
R5 0.22Ω 2W
R6 1.5K
R7 100
R8 10
R9 10 1W
R10 2.4Ω 1/2W
R11 1GK
R12 33K
R13 FSV
R16 1GK
R17 3.9K
R18 FSV
R19 2.2K
R20 10 1W
R21 3.3
R22 3K
R23 3K
C5 .1μF
C6 180 PF
C7 10μF
C9 .01μF
C11 .01μF
C12 1500 PF 500V
TP(+5V)
TP(GND)
TP(+20V)
TP(-20V)
TP(+200V)
J4-3
J1-2
J2-17
J2-18
+5V
J4-10
J1-B
J1-3
J2-U
J2-V
J4-L
GND
J4-7
J1-C
J2-S
+20V
J4-8
J1-4
-20V
J2-P +200V
J4-K
J1-F
J2-T
GUARD
CONVERTER
SPARE
PART OF J4
PART OF J1
PART OF J2
DIGITAL
ANALOG
SPARE
SPARE
+11 V REF
DC + AC
ZERO
Ro
R1 + Ro
R2
R3
R4 (DC+AC)
FIL
EXT REF
DC
AC
KΩ
REMOTE (FUNCT.)
2E
2D
2C
2B
2A
1
ZERO SW
EX
ER
INT TRIG
EXT TRIG
PRINT
POL
COMPARATOR
REVISIONS
A C9 WAS 500 PF FROM VR2-2 TO VR2-9 C11 WAS 100 PF FROM VR3-2 TO VR3-9 11-28-72
B GENERAL CLEAN-UP OF ADCN'S 7-16-73
C INCORP ECO. 565, 591 & 592 1-31-74
D REVERSED F1 CONNECTION 11-1-74
E INC E0670 11-15-74
LIST OF MATERIAL
CIMRON
SCHEMATIC - POWER SUPPLY ASSY A4
D 15318 200431 E
SCALE NONE
SHEET 1 OF 1
APPLICATION
REF 200430 200400
2. PARTIAL REF DESIGNATIONS SHOWN, FOR COMPLETE DESIGNATOR, PREFIX WITH A4.
1. ALL RESISTANCE VALUES IN OHMS ±5%, 1/4 W.
NOTES: UNLESS OTHERWISE SPECIFIED
97-9
200431 E



6. FOR CHECKOUT PROCEDURE SEE 200488.
5. PARTIAL REF DESIGNATIONS SHOWN, FOR COMPLETE DESIGNATOR, PREFIX WITH A4
4. APPLY GLASS CLOTH TAPE TO FAR SIDE AS SHOWN AFTER ASSY
3.
2.
1. REF. SCHEMATIC NO. 200431

NOTES: UNLESS OTHERWISE SPECIFIED

G. L. NICHOLSON 9/10/72

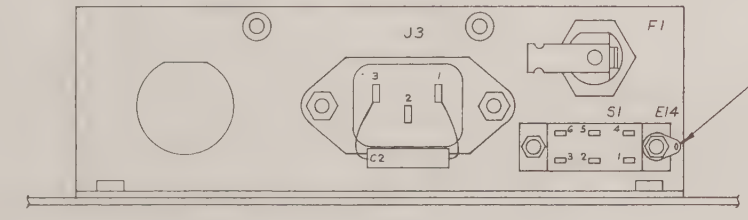
BOARD ASSEMBLY-
POWER SUPPLY
A4

200430 H

-01 1 200400 DMM50 1

M. Turner 9-27-72 DMM50 2 7

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
	SEE SHEET 1		



VIEW A-A (ROTATED 180°)

VIEW B-B
FULL SIZE

6-28

200430 H

APPLICATION	SCALE 2/1	RELEASE DMM 50	SHEET 3 OF 7

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A4	200430-01	ASSEMBLY	16067		
	200432-04	CIRCUIT BOARD	16067	1-60223	1
					2
					3
					4
					5
A4C1A	39D258G015JL4	CAPACITOR 2500μF 15V	56289	6-10971	6
A4C1B	39D258G015JL4	CAPACITOR 2500μF 15V	56289	6-10971	7
A4C2	ZD10A683J	CAPACITOR .068μF 1000V	12406	6-10972	8
A4C3	39D538G015JP4	CAPACITOR 5300μF 15V	56289	6-10973	9
A4C4	2222/063/90041	CAPACITOR 1000μF 50V	73445	6-10974	10
A4C5	C280AE/A100K	CAPACITOR .1μF 250V	73445	6-10916	11
A4C6	DD181	CAPACITOR 180pF 1KV	71590	6-10059	12
A4C7	T362B106M015AS	CAPACITOR 10μF 15V	05397	6-10965	13
A4C8	2222/063/90041	CAPACITOR 1000μF 50V	73445	6-10974	14
A4C9	C280AE/A10K	CAPACITOR .01μF 250V	73445	6-10929	15
A4C10	C436AR/N25	CAPACITOR 25μF 300V	73445	6-10934	16
A4C11	C280AE/A10K	CAPACITOR .01μF 250V	73445	6-10929	17
A4C12	DM19-152J	CAPACITOR 1500pF 500V	72136	6-10302	18
					19
					20
					21
					22
					23
A4CR1	KBP005	DIODE RECT. BRIDGE	77638	3-10237	24
A4CR2	1N5197	DIODE RECT.	72699	3-10244	25
A4CR3	1N5197	DIODE RECT.	72699	3-10244	26
A4CR4	1N4002	DIODE RECT.	81349	3-10162	27
A4CR5	1N4002	DIODE RECT.	81349	3-10162	28
A4CR6	1N5731B	DIODE ZENER 6.2V	25403	3-10235	29
A4CR7	2N4441	DIODE THYRISTOR	81349	3-30265	30
A4CR8	1N4002	DIODE RECT.	81349	3-10162	31
A4CR9	1N4002	DIODE RECT.	81349	3-10162	32
A4CR10	PD05	DIODE RECT. BRIDGE	83701	3-10245	33

MODEL	CALICO P/N	ASSY R.D.
DMM 50	200430	
TITLE POWER SUPPLY BOARD ASSEMBLY	SHT 4 OF 7	A4

CALIFORNIA INSTRUMENTS CO. SAN DIEGO, CALIFORNIA	CODE IDENT 16067	PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A4CR11	1N5731B	DIODE ZENER 6.2V	25403	3-10235	34
					35
					36
					37
					38
A4F1	313.375	FUSE 3/8A S.B. (115V)	75915	2-40259	39
	323.250 *	FUSE 1/4A S.B. (250V)	75915	2-70060	40
	(* FOR 230V ONLY)				41
A4J1	225-21821-105	CONN. 18 PIN	02660	4-10227	42
A4J2	225-21821-105	CONN. 18 PIN	02660	4-10227	43
A4J3	EAC 301	RECEPTACLE - LINE CORD	82389	4-10228	44
					45
					46
					47
A4Q1	T1P33	TRANSISTOR NPN PWR	01295	3-30258	48
A4Q2	T1P33	TRANSISTOR NPN PWR	01295	3-30258	49
A4Q3	2N4402	TRANSISTOR PNP	27014	3-30259	50
A4Q4	T1P34	TRANSISTOR PNP PWR	01295	3-30267	51
					52
					53
					54
A4R1	RC07GF272J	RESISTOR 2.7K 5% 1/4W	81349	5-10062	55
A4R2	RC07GF TBD	RESISTOR TBD	81349		56
A4R3	RC07GF512J	RESISTOR 5.1K 5% 1/4W	81349	5-10069	57
A4R4	RC42GF271J	RESISTOR 270Ω 5% 2W	81349	5-40025	58
A4R5	TYPE BWH	RESISTOR .22Ω 10% 2W	75042	5-40061	59
A4R6	RC07GF152J	RESISTOR 1.5K 5% 1/4W	81349	5-10057	60
A4R7	RC07GF101J	RESISTOR 100Ω 5% 1/4W	81349	5-10029	61
A4R8	RC07GF100J	RESISTOR 10Ω 5% 1/4W	81349	5-10005	62
A4R9	RC32GF100J	RESISTOR 10Ω 5% 1W	81349	5-30001	63
A4R10	RC20GF2R4J	RESISTOR 2.4Ω 5% 1/2W	81349	5-20132	64
A4R11	RC07GF163J	RESISTOR 16K 5% 1/4W	81349	5-10081	65
A4R12	RC07GF393J	RESISTOR 39K 5% 1/4W	81349	5-10090	66
A4R13	RC07GF TBD	RESISTOR TBD	81349		67
A4R14	RC20GF132J	RESISTOR 1.3K 5% 1/2W	81349	5-20037	68
A4R15	RC07GF224J	RESISTOR 220K 5% 1/4W	81349	5-10108	69

MODEL	CALICO P/N	ASSY R.D.
DMM 50	200430	
TITLE	SHT OF	
POWER SUPPLY BOARD ASSEMBLY	5 7	A4

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A4R16	RC07GF163J	RESISTOR 16K 5% 1/4W	81349	5-10081	70
A4R17	RC07GF392J	RESISTOR 3.9K 5% 1/4W	81349	5-10066	71
A4R18	RC07GF TBD	RESISTOR TBD	81349		72
A4R19	RC07GF222J	RESISTOR 2.2K 5% 1/4W	81349	5-10060	73
A4R20	RC32GF100J	RESISTOR 10Ω 5% 1W	81349	5-30001	74
A4R21	RC20GF3R3J	RESISTOR 3.3Ω 5% 1/2W	81349	5-20001	75
A4R22	RC07GF302J	RESISTOR 3K 5% 1/4W	81349	5-10063	76
A4R23	RC07GF302J	RESISTOR 3K 5% 1/4W	81349	5-10063	77
					78
					79
					80
					81
					82
					83
					84
A4S1	46206LF	SWITCH, SLIDE 115-230V	82389	2-40298	85
					86
					87
A4T1	200495-01	POWER TRANSFORMER	16067	7-10265	88
					89
					90
A4VR1	723HC	I. C. REG.	02335	3-60020	91
A4VR2	723HC	I. C. REG.	02335	3-60020	92
A4VR3	723HC	I. C. REG.	02335	3-60020	93
					94
					95
A4XF1	345001	FUSE HOLDER	75915	2-40264	96
					97
					98
					99
	200433-01	XFORMER MTG. BKT.	16067	1-10482	100
	200449-01	HEATSINK	16067	2-10530	101
	200450-01	HEATSINK	16067	2-10531	102
	200434-01	BKT - RIGHT ANGLE	16067	1-10477	103
	200419-01	BKT - REAR INPUT	16067	1-10484	104
					105

MODEL DMM 50 | CALICO P/N 200430 | ASSY R.D. A4

TITLE POWER SUPPLY BOARD ASSEMBLY | SHT 6 OF 7

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
					106
					107
	8231-B-0440-3A	SPACER 1/4 HEX x $1^3/4$ LG	06540	2-10532	108
	1028-2	TERM. SWAGE, SLOTTED	71279	2-50229	109
					110
	.002 THK x .62WIDE	CLEAR MYLAR TAPE			111
	22 GA WHT	WIRE INS.			112
	22 GA SHLD	WIRE 2 COND. TWISTED			113
					114
	1412-4	TERM. LUG	83330	2-50115	115
	NW4-2813	WASHER, NYLON FLAT	95987	2-10533	116
					117
					118
					119
	2829-75-4	MOUSE TAIL	98159	2-10402	120
					121
	#8	LKWASH, INT STAR			122
					123
					124
					125
					126
					127
					128
					129
					130
					131
					132
					133
					134
					135
					136
					137
					138
					139
					140
					141

MODEL DMM 50 | CALICO P/N 200430 | ASSY R.D. A4

TITLE POWER SUPPLY BOARD ASSEMBLY | SHT 7 OF 7

A3 ASSEMBLY

DIGITAL CIRCUITRY

REVISIONS					
SHT	ZONE	LTR	DESCRIPTION	DATE	APPROVED
1	2E	A	R29 WAS 3.3K	9/23/71	[illegible]
2	2G 8D	·	INCORPORATED ADCN 1	11/24/72	W Tarran
		B	GENERAL CLEAN-UP OF ADCN'S	7/9/73	[illegible]
1/2		C	INCORP. ECO 391595 ~ 2-4-74	2/7/74	[illegible]
1/2		D	DDC DELETED PN'S - INC ECO 669	11/20/74	[illegible]

PART OF A1 DISPLAY BD ASSY 200445-01

DS1 B9=ANODE

DS2 B9=ANODE

DS3 (SAME AS DS2)

DS4 (MV2a)

MATING CONNECTORS TO THIS ASSEMBLY

J2 P1 — PWR SUPPLY SCH. 200431

J1 P1 — DISPLAY (THIS DRAWING)

DIGITAL BOARD THIS DRAWING (2 SHEETS)

P1 J2 — DATA OUTPUT REM. PROG. SCH. 200436

PART OF P1

PART OF J1

+5V R4 1K

K

J2-1 +5V

+5V P1-17

P1-18

C1-C14 .1

P1-U +200V

GND P1-V

J2-A

R1 5.6M

R2 1K

+200V P1-P +200V

+20V P1-S +20V

GUARD P1-T GUARD

J2-2

C15 .1

DS1 NE1

R3 220

C34 .01

Z29 Z28 Z49 Z49

R5 1K

R6 1K +5V

Q1

R7 10K

R8 150K

R9 2.2K +200V

R10 68K

Q2 Q3 Q4

R11 10K

R12 110K

R13 130K

R14 10K

R15 2.2K +200V

R16 11K +5V

R17 2.2K +200V

R18 11K +5V

R19 2.2K +200V

R20 11K +5V

R21 2.2K +200V

R22 11K +5V

R23 2.2K +200V

R24 11K +5V

Z2 Z3 Z4 Z5 Z6 Z9 Z10 Z11 Z12 Z13 Z14

+5V

STORE

J2-E OVERSCALE

P1-8 DC

CC

J2-D COUNT DN

POL

COMP. P1-2

POL J2-N

POL P1-13

2E P1-N

2D P1-E

2C P1-F

2B P1-4

2A P1-G

P1-5

Z44 Z44 Z44 Z44

Z45 Z45 Z45 Z45 Z45 Z45 Z45

Z7 Z35 Z26

Z25 Z25 Z25 Z25 Z25 Z25 Z25 Z25

POL Z18

Z56 Z56

R25 1K +5V

Z29 Z29 Z28

Z18

R26 1K +5V

Z19 10^4 Z20 10^3 Z21 10^2 Z22 10^1 Z23 10^0

D C B A CLD C B A L

Ro Ro Ro Ro

Z34

Z30 Z31 Z31 Z31 Z31

C17 .0033

R30 1K +5V

Z49 Z24 Z40 Z38

Z32 Z32 Z34

Z24 Z63 Z63 Z40

C18 .0033

C19 68PF

R31 100

R32 1K

Q5 +5V R27 470 R29 1.2K

RO

S1

8K

DAC

Z33 Z43 Z43 Z33

CR1 IN4148

S2

Z64 J2-8 GATED CLOCK

Z54 +5V R28 1K

R33 10K C33 100 PF C20 180 PF L1 100 UH

Z64 Z64 Z64

Y1 1.2 MHZ (60 HZ) 1.0 MHZ & C33 (50 HZ)

S2

ER

Z43 Z43

Z58 Z58

C21 .043

C22 68PF R34 100

R35 1K

Z00000 LOAD TI ZERO SW ZERO ZERO SW AA E.O.D. EX START 12XXXX

STOP

NOTE: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE IN OHMS, ±5%, .25W.
2. ALL CAPACITORS ARE IN MICROFARADS.
3. TRANSISTORS Q1,3,6,8-14 ARE 2N4400, Q2-4 ARE 2N5550, Q7 IS 2N4871.
4. PARTIAL REF. DESIGNATIONS SHOWN, FOR COMPLETE DESIGNATOR, PREFIX WITH A3.

REF. DESIGNATION	P/N	+5V	GND	REF. DESIGNATION	P/N	+5V	GND
Z1	SN7441AN	5	12	Z28,30,39,43,44,52	SN7400N	14	7
Z2-6	DD700	16	8	Z53, 58-60,64,63			
Z7,29,33,38,47,48	SN7410N	14	7	Z31,55	SN7486N	14	7
Z8,16,27,41,51	SN7432N	14	7	Z42	SN7440N	14	7
Z9-14	SN7475N	5	12	Z45	SN7416N	14	7
Z15,18,54,62	SN7476N	5	13	Z46,61,56	SN7403N	14	7
Z17,26,35	SN7451N	14	7	Z50	8N74121N	14	7
Z19,36	SN74192N	16	8				
Z20-23	SN7490N	5	10				
Z24,32,57	SN7420N	14	7				
Z25,34,37,40,49	SN7404N	14	7				

REF DASH NO	200440 NEXT ASSY	200400 USED ON
	APPLICATION	

UNLESS OTHERWISE SPECIFIED DIM. IN INCHES TOLERANCES x ± .1 xx ± .03 xxx ± .010 ANGLES ± 0.5° MACH. FIN.

CONTR NO.
DR G.L. NICHOLSON 9/6
CHK
DSGN
ENGR 9/6/72
PROJ
REL R 2770 dec. d. 9/6/72
APPD
APPD

SCHEMATIC - DIGITAL BOARD ASSY A3

SIZE	CODE IDENT NO	DWG NO.	LTR
E	98438	200441	D
SCALE NONE		DMM 50	SHEET 1 OF 2

200441 D B

SEE SHEET 1 FOR MATING CONNECTOR INFORMATION

PART OF A1

DS3-B8 DS2-A8 DS2-B8 DS1-A8 DS1-B8

PART OF P1

PART OF J1

K Ω P1-10 J2-4

R0 P1-C

DATA READY J2-K

RC J2-9

RA J2-J

R5·KΩ P1-14

R4 P1-15

R3 P1-L

R2 P1-M

AC J2-3

RB J2-L

R1 + R0 P1-12

R4(DC+AC) P1-K

DC·AC J2-7

REMOTE (FUNCT) P1-H J2-8

DC·AC P1-1

EXT. REF. P1-J J2-G

FIL P1-9 J2-5

R5 J2-15

R4 J2-R

R3 J2-14

R2 J2-P

R1 J2-13

R0 J2-12

REMOTE (RANGE) J2-S

S1 .1 1 10 100 1K 10K AUTO REM

DC AC KΩ

PI-7 PRINT

STORE

POL

START

FRONT PANEL (REF) SAMPLE RATE GENERATOR

+20V +5V +200V

TP1 TP2

PI-3 EXT. TRIG

PI-D INT. TRIG.

J2-M EXT. TRIG. (PULSE)

AA

S2

LOAD II

K

12 XXXX

START

8K

DAC

E.O.D.

STOP

S2

S1

ER

CC

ZERO SW

ZERO SW PI-B

ZERO SW

00007

ZERO J2-C

ZERO PI-A

ZERO

EX

EX PI-R

ER PI-16

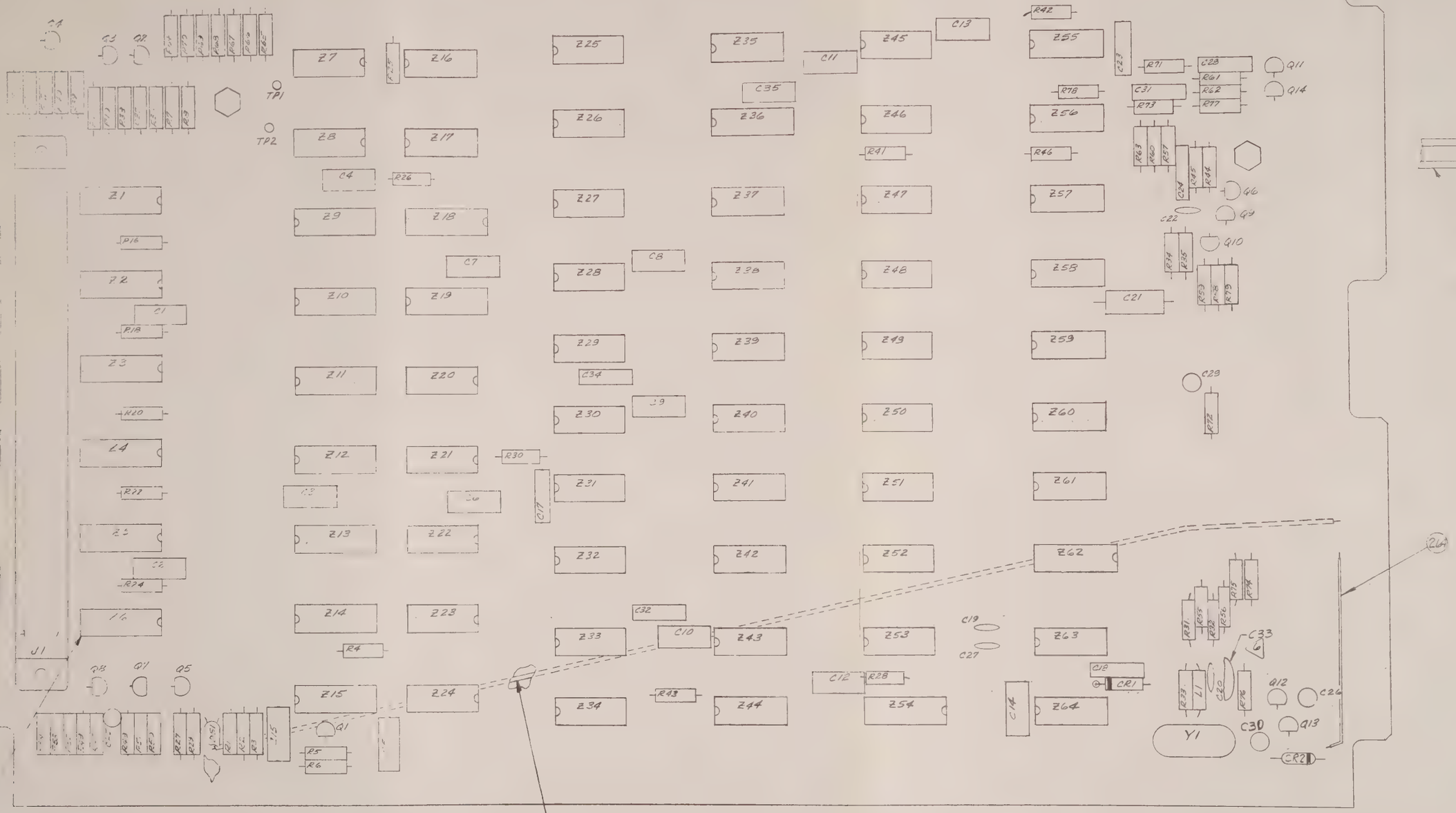
AUTO

WAIT

SIZE	CODE IDENT NO	DWG NO.	LTR
E	98438	200441	D
SCALE NONE		DMM 50	SHEET 1

E	INCORP. ADCN'S 3,4 & 5. DELETED HOLES ADDED BY ADCN 3. R36-40, 180K WAS 300K. ADDED R80-84. REMOVED JUMPERS W1, W2 & W3.	5/23/73	J. Knudsen
/	SEE SHEET 1.	5/23/73	H. Turner

E	REDESIGNED & REDRAWN	4-25-72	J. Knudsen
C	INCORP. ADCN 1. ZONE A7, R29 WAS 3.3K. ADDED W3-A,B&C (ZONE B6), ADDED WIRE AT W1-A&B (ZONE C4). ZONE C3, R45 3.3K WAS 10K & ADDED R79, 1K. ADDED GN 5.	4-25-72	W. Turner
D	INCORP ADCN 2, REORIENTED Q7		W. Turner



1. PK C33 VALUE SEE PL 200454 (OPTION C9 50Hz OPERATION).
2. ITEM 1 - X26
3. SECURE IN PLACE WITH LOCTITE #242 (BLUE).
4. REMOVE ITEM 3 TO S1 AND BUTTON USING HYSOL EPOXY
5. APPLY ITEM 263 BETWEEN BOARD AND CHASSIS OF S1

1. REF SCHEMATIC NO. 200441

SEE SEPARATE PARTS LIST

A.P. KNUDSEN 4-14-72
J. WICKLAND 4-14-72
W. TURNER 4-14-72

-01 | 200400 DMM50

BOARD ASSEMBLY-DIGITAL

200440

DMM50

A3

6-36

CALIFORNIA INSTRUMENTS CO. SAN DIEGO, CALIFORNIA	CODE IDENT 16067	PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
	200440-01	ASSEMBLY	16067		
					1
	200442-04	CIRCUIT BOARD	16067	1-60213	2
	200443-01	PUSH BUTTON EXTENDER	16067	2-40457	3
A3S1	8-64211	PUSH BUTTON SWITCH	16067	2-40456	4
					5
					6
					7
					8
A3C1	C280AE/A100K	CAPACITOR .1μF 250V	73445	6-10916	9
A3C2	C280AE/A100K	CAPACITOR .1μF 250V	73445	6-10916	10
A3C3	C280AE/A100K	CAPACITOR .1μF 250V	73445	6-10916	11
A3C4	C280AE/A100K	CAPACITOR .1μF 250V	73445	6-10916	12
A3C5	C280AE/A100K	CAPACITOR .1μF 250V	73445	6-10916	13
A3C6	C280AE/A100K	CAPACITOR .1μF 250V	73445	6-10916	14
A3C7	C280AE/A100K	CAPACITOR .1μF 250V	73445	6-10916	15
A3C8	C280AE/A100K	CAPACITOR .1μF 250V	73445	6-10916	16
A3C9	C280AE/A100K	CAPACITOR .1μF 250V	73445	6-10916	17
A3C10	C280AE/A100K	CAPACITOR .1μF 250V	73445	6-10916	18
A3C11	C280AE/A100K	CAPACITOR .1μF 250V	73445	6-10916	19
A3C12	C280AE/A100K	CAPACITOR .1μF 250V	73445	6-10916	20
A3C13	C280AE/A100K	CAPACITOR .1μF 250V	73445	6-10916	21
A3C14	C280AE/A100K	CAPACITOR .1μF 250V	73445	6-10916	22
A3C15	C280AE/A100K	CAPACITOR .1μF 250V	73445	6-10916	23
A3C16	NOT USED				24
A3C17	C280AE/A3K3	CAPACITOR .0033μF 250V	73445	6-10961	25
A3C18	C280AE/A3K3	CAPACITOR .0033μF 250V	73445	6-10961	26
A3C19	DD680	CAPACITOR 68pF 1000V	71590	6-10962	27
A3C20	CM05F181F03	CAPACITOR 180pF 500V 1%	81349	6-10963	28
A3C21	B1A433K	CAPACITOR .043μF 100V 1%	12400	6-10964	29
A3C22	DD680	CAPACITOR 68pF 1000V	71590	6-10962	30

MODEL DMM 50	CALICO P/N 200440	ASSY R.D. A3
TITLE DIGITAL BOARD ASSEMBLY	SHT 3 OF 10	

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A3C23	C280AE/A10K	CAPACITOR .01μF 250V	73445	6-10929	31
A3C24	C280AE/A3K3	CAPACITOR .0033μF 250V	73445	6-10961	32
A3C25	T362B106M015AS	CAPACITOR 10μF 15V	05397	6-10965	33
A3C26	T362A335M015AS	CAPACITOR 3.3μF 15V	05397	6-10966	34
A3C27	DD680	CAPACITOR 68pF 1000V	71590	6-10962	35
A3C28	C280AE/A10K	CAPACITOR .01μF 250V	73445	6-10929	36
A3C29	T362A685M015AS	CAPACITOR 6.8μF 15V	05397	6-10953	37
A3C30	T362B336M010AS	CAPACITOR 33μF 10V	05397	6-10751	38
A3C31	C280AE/A3K3	CAPACITOR .0033μF 250V	73445	6-10961	39
A3C32	C280AE/A3K3	CAPACITOR .0033μF 250V	73445	6-10961	40
A3C33	PART OF OPTION "09" (PL 200454)				41
A3C34	C280AE/A10K	CAPACITOR .01μF 250V	73445	6-10929	42
A3C35	C280AE/A100K	CAPACITOR .1μF 250V	73445	6-10916	43
					44
					45
					46
					47
					48
A3CR1	1N4148	DIODE	25403	3-10227	49
A3CR2	1N270	DIODE	81349	3-10006	50
					51
					52
A3DS1	NE-2H	LAMP, NEON	08806	2-50236	53
					54
					55
A3J1	225-22821-110	CONNECTOR 28 PIN	02660	4-10222	56
					57
A3L1	DD100	CHOKE 100μH	43543	5-90057	58
					59
					60
A3Q1	2N4400	TRANSISTOR	81349	3-30257	61
A3Q2	2N5550	TRANSISTOR	81349	3-30255	62
A3Q3	2N5550	TRANSISTOR	81349	3-30255	63
A3Q4	2N5550	TRANSISTOR	81349	3-30255	64
A3Q5	2N4400	TRANSISTOR	81349	3-30257	65
A3Q6	2N4400	TRANSISTOR	81349	3-30257	66

MODEL	CALICO P/N	ASSY R.D.
DMM 50	200440	A3
TITLE	SHT OF	
DIGITAL BOARD ASSEMBLY	4 10	

CALIFORNIA INSTRUMENTS CO. SAN DIEGO, CALIFORNIA	CODE IDENT 16067	PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A3Q7	2N4871	TRANSISTOR UNIJUNCTION	04713	3-30264	67
A3Q8	2N4400	TRANSISTOR	81349	3-30257	68
A3Q9	2N4400	TRANSISTOR	81349	3-30257	69
A3Q10	2N4400	TRANSISTOR	81349	3-30257	70
A3Q11	2N4400	TRANSISTOR	81349	3-30257	71
A3Q12	2N4400	TRANSISTOR	81349	3-30257	72
A3Q13	2N4400	TRANSISTOR	81349	3-30257	73
A3Q14	2N4400	TRANSISTOR	81349	3-30257	74
					75
					76
					77
					78
A3R1	RC07GF565J	RESISTOR 5.6M 5% 1/4W	81349	5-10160	79
A3R2	RC07GF102J	RESISTOR 1K 5% 1/4W	81349	5-10053	80
A3R3	RC07GF221J	RESISTOR 220Ω 5% 1/4W	81349	5-10037	81
A3R4	RC07GF102J	RESISTOR 1K 5% 1/4W	81349	5-10053	82
A3R5	RC07GF102J	RESISTOR 1K 5% 1/4W	81349	5-10053	83
A3R6	RC07GF102J	RESISTOR 1K 5% 1/4W	81349	5-10053	84
A3R7	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	85
A3R8	RC07GF154J	RESISTOR 150K 5% 1/4W	81349	5-10104	86
A3R9	RC07GF222J	RESISTOR 2.2K 5% 1/4W	81349	5-10060	87
A3R10	RC07GF683J	RESISTOR 68K 5% 1/4W	81349	5-10096	88
A3R11	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	89
A3R12	RC07GF114J	RESISTOR 110K 5% 1/4W	81349	5-10101	90
A3R13	RC07GF134J	RESISTOR 130K 5% 1/4W	81349	5-10103	91
A3R14	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	92
A3R15	RC07GF222J	RESISTOR 2.2K 5% 1/4W	81349	5-10060	93
A3R16	RC07GF113J	RESISTOR 11K 5% 1/4W	81349	5-10077	94
A3R17	RC07GF222J	RESISTOR 2.2K 5% 1/4W	81349	5-10060	95
A3R18	RC07GF113J	RESISTOR 11K 5% 1/4W	81349	5-10077	96
A3R19	RC07GF222J	RESISTOR 2.2K 5% 1/4W	81349	5-10060	97
A3R20	RC07GF113J	RESISTOR 11K 5% 1/4W	81349	5-10077	98
A3R21	RC07GF222J	RESISTOR 2.2K 5% 1/4W	81349	5-10060	99
A3R22	RC07GF113J	RESISTOR 11K 5% 1/4W	81349	5-10077	100
A3R23	RC07GF222J	RESISTOR 2.2K 5% 1/4W	81349	5-10060	101
A3R24	RC07GF113J	RESISTOR 11K 5% 1/4W	81349	5-10077	102

MODEL DMM 50	CALICO P/N 200440	ASSY R.D. A3
TITLE DIGITAL BOARD ASSEMBLY	SHT 5 OF 10	

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A3R25	RC07GF102J	RESISTOR 1K 5% 1/4W	81349	5-10053	10
A3R26	RC07GF102J	RESISTOR 1K 5% 1/4W	81349	5-10053	10
A3R27	RC07GF471J	RESISTOR 470Ω 5% 1/4W	81349	5-10045	10
A3R28	RC07GF102J	RESISTOR 1K 5% 1/4W	81349	5-10053	10
A3R29	RC07GF122J	RESISTOR 1.2K 5% 1/4W	81349	5-10055	10
A3R30	RC07GF102J	RESISTOR 1K 5% 1/4W	81349	5-10053	10
A3R31	RC07GF101J	RESISTOR 100Ω 5% 1/4W	81349	5-10029	10
A3R32	RC07GF102J	RESISTOR 1K 5% 1/4W	81349	5-10053	11
A3R33	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	11
A3R34	RC07GF101J	RESISTOR 100Ω 5% 1/4W	81349	5-10029	11
A3R35	RC07GF102J	RESISTOR 1K 5% 1/4W	81349	5-10053	11
A3R36	RC07GF184J	RESISTOR 180K 5% 1/4W	81349	5-10106	11
A3R37	RC07GF184J	RESISTOR 180K 5% 1/4W	81349	5-10106	11
A3R38	RC07GF184J	RESISTOR 180K 5% 1/4W	81349	5-10106	11
A3R39	RC07GF184J	RESISTOR 180K 5% 1/4W	81349	5-10106	11
A3R40	RC07GF184J	RESISTOR 180K 5% 1/4W	81349	5-10106	11
A3R41	RC07GF102J	RESISTOR 1K 5% 1/4W	81349	5-10053	11
A3R42	RC07GF102J	RESISTOR 1K 5% 1/4W	81349	5-10053	12
A3R43	RC07GF102J	RESISTOR 1K 5% 1/4W	81349	5-10053	12
A3R44	RC07GF682J	RESISTOR 6.8K 5% 1/4W	81349	5-10072	12
A3R45	RC07GF332J	RESISTOR 3.3K 5% 1/4W	81349	5-10064	12
A3R46	RC07GF102J	RESISTOR 1K 5% 1/4W	81349	5-10053	12
A3R47	RC07GF101J	RESISTOR 100Ω 5% 1/4W	81349	5-10029	12
A3R48	RC07GF154J	RESISTOR 150K 5% 1/4W	81349	5-10104	12
A3R49	RC07GF222J	RESISTOR 2.2K 5% 1/4W	81349	5-10060	12
A3R50	RC07GF183J	RESISTOR 18K 5% 1/4W	81349	5-10082	12
A3R51	RC07GF102J	RESISTOR 1K 5% 1/4W	81349	5-10053	12
A3R52	RC07GF102J	RESISTOR 1K 5% 1/4W	81349	5-10053	13
A3R53	RC07GF332J	RESISTOR 3.3K 5% 1/4W	81349	5-10064	13
A3R54	RC07GF222J	RESISTOR 2.2K 5% 1/4W	81349	5-10060	13
A3R55	RC07GF101J	RESISTOR 100Ω 5% 1/4W	81349	5-10029	13
A3R56	RC07GF102J	RESISTOR 1K 5% 1/4W	81349	5-10053	13
A3R57	RC07GF271J	RESISTOR 270Ω 5% 1/4W	81349	5-10039	13
A3R58	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	13
A3R59	RC07GF472J	RESISTOR 4.7K 5% 1/4W	81349	5-10068	13
A3R60	RC07GF102J	RESISTOR 1K 5% 1/4W	81349	5-10053	13

MODEL DMM 50 | CALICO P/N 200440 | ASSY R.D. A3

TITLE DIGITAL BOARD ASSEMBLY | SHT 6 OF 10

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A3R61	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	139
A3R62	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	140
A3R63	RC07GF102J	RESISTOR 1K 5% 1/4W	81349	5-10053	141
A3R64	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	142
A3R65	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	143
A3R66	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	144
A3R67	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	145
A3R68	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	146
A3R69	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	147
A3R70	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	148
A3R71	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	149
A3R72	RC07GF303J	RESISTOR 30K 5% 1/4W	81349	5-10087	150
A3R73	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	151
A3R74	RC07GF472J	RESISTOR 4.7K 5% 1/4W	81349	5-10068	152
A3R75	RC07GF104J	RESISTOR 100K 5% 1/4W	81349	5-10100	153
A3R76	RC07GF223J	RESISTOR 22K 5% 1/4W	81349	5-10084	154
A3R77	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	155
A3R78	RC07GF331J	RESISTOR 330Ω 5% 1/4W	81349	5-10041	156
A3R79	RC07GF102J	RESISTOR 1K 5% 1/4W	81349	5-10053	157
A3R80	RC07GF205J	RESISTOR 2M 5% 1/4W	81349	5-10159	158
A3R81	RC07GF205J	RESISTOR 2M 5% 1/4W	81349	5-10159	159
A3R82	RC07GF205J	RESISTOR 2M 5% 1/4W	81349	5-10159	160
A3R83	RC07GF205J	RESISTOR 2M 5% 1/4W	81349	5-10159	161
A3R84	RC07GF205J	RESISTOR 2M 5% 1/4W	81349	5-10159	162
					163
					164
					165
					166
					167
					168
					169
A3TP1	1028-2	TURRET TERM.	71279	2-50229	170
A3TP2	1028-2	TURRET TERM.	71279	2-50229	171
					172
					173
					174

MODEL DMM 50 | CALICO P N 200440 | ASSY R.D. A3

TITLE DIGITAL BOARD ASSEMBLY | SHT 7 OF 10

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A3XZ1	CA-16S-TSD	I. C. SOCKET 16 PIN	52072	2-30057	17
A3XZ2	CA-16S-TSD	I. C. SOCKET 16 PIN	52072	2-30057	17
A3XZ3	CA-16S-TSD	I. C. SOCKET 16 PIN	52072	2-30057	17
A3XZ4	CA-16S-TSD	I. C. SOCKET 16 PIN	52072	2-30057	17
A3XZ5	CA-16S-TSD	I. C. SOCKET 16 PIN	52072	2-30057	17
A3XZ6	CA-16S-TSD	I. C. SOCKET 16 PIN	52072	2-30057	18
					18
					18
					18
A3Z1	SN7441AN	I. C. DECODER/DR	01295	3-60003	18
A3Z2	DD700	I. C. DECODER/DR	07713	3-60053	18
A3Z3	DD700	I. C. DECODER/DR	07713	3-60053	18
A3Z4	DD700	I. C. DECODER/DR	07713	3-60053	18
A3Z5	DD700	I. C. DECODER/DR	07713	3-60053	18
A3Z6	DD700	I. C. DECODER/DR	07713	3-60053	18
A3Z7	SN7410N	I. C. GATE, NAND	01295	3-60051	19
A3Z8	SN7432N	I. C. GATE, OR	01295	3-60064	19
A3Z9	SN7475N	I. C. QUAD LATCH	01295	3-60004	19
A3Z10	SN7475N	I. C. QUAD LATCH	01295	3-60004	19
A3Z11	SN7475N	I. C. QUAD LATCH	01295	3-60004	19
A3Z12	SN7475N	I. C. QUAD LATCH	01295	3-60004	19
A3Z13	SN7475N	I. C. QUAD LATCH	01295	3-60004	19
A3Z14	SN7475N	I. C. QUAD LATCH	01295	3-60004	19
A3Z15	SN7476N	I. C. FL-FL DUAL	01295	3-60070	19
A3Z16	SN7432N	I. C. GATE, OR	01295	3-60064	19
A3Z17	SN7451N	I. C. GATE AND/OR	01295	3-60077	20
A3Z18	SN7476N	I. C. FL-FL DUAL	01295	3-60070	20
A3Z19	SN74192N	I. C. COUNT DEC	01295	3-60014	20
A3Z20	SN7490N	I. C. DECADE/DR	01295	3-60005	20
A3Z21	SN7490N	I. C. DECADE/DR	01295	3-60005	20
A3Z22	SN7490N	I. C. DECADE/DR	01295	3-60005	20
A3Z23	SN7490N	I. C. DECADE/DR	01295	3-60005	20
A3Z24	SN7420N	I. C. GATE NAND	01295	3-60012	20
A3Z25	SN7404N	I. C. HEX INV.	01295	3-60002	20
A3Z26	SN7451N	I. C. GATE AND/OR	01295	3-60077	20
A3Z27	SN7432N	I. C. GATE, OR	01295	3-60064	21

MODEL DMM 50 | CALICO P/N 200440 | ASSY R.D. A3

TITLE DIGITAL BOARD ASSEMBLY | SHT 8 OF 10

CALIFORNIA INSTRUMENTS CO. SAN DIEGO, CALIFORNIA	CODE IDENT 16067	PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A3Z28	SN7400N	I. C. GATE, QUAD	01295	3-60000	211
A3Z29	SN7410N	I. C. GATE, NAND	01295	3-60051	212
A3Z30	SN7400N	I. C. GATE, QUAD	01295	3-60000	213
A3Z31	SN7486N	I. C. EXCLUSIVE OR	01295	3-60062	214
A3Z32	SN7420N	I. C. GATE NAND	01295	3-60012	215
A3Z33	SN7410N	I. C. GATE, NAND	01295	3-60051	216
A3Z34	SN7404N	I. C. HEX. INV.	01295	3-60002	217
A3Z35	SN7451N	I. C. GATE AND/OR	01295	3-60077	218
A3Z36	SN74192N	I. C. COUNT DEC.	01295	3-60014	219
A3Z37	SN7404N	I. C. HEX. INV.	01295	3-60002	220
A3Z38	SN7410N	I. C. GATE, NAND	01295	3-60051	221
A3Z39	SN7400N	I. C. GATE, QUAD	01295	3-60000	222
A3Z40	SN7404N	I. C. HEX. INV.	01295	3-60002	223
A3Z41	SN7432N	I. C. GATE, OR	01295	3-60064	224
A3Z42	SN7440N	I. C. BUF DUAL	01295	3-60063	225
A3Z43	SN7400N	I. C. GATE, QUAD	01295	3-60000	226
A3Z44	SN7400N	I. C. GATE, QUAD	01295	3-60000	227
A3Z45	SN7416N	I. C. BUF DR. HEX.	01295	3-60078	228
A3Z46	SN7403N	I. C. GATE NAND	01295	3-60076	229
A3Z47	SN7410N	I. C. GATE, NAND	01295	3-60051	230
A3Z48	SN7410N	I. C. GATE, NAND	01295	3-60051	231
A3Z49	SN7404N	I. C. HEX. INV.	01295	3-60002	232
A3Z50	SN74121N	I. C. MULTI-MONO	01295	3-60079	233
A3Z51	SN7432N	I. C. GATE, OR	01295	3-60064	234
A3Z52	SN7400N	I. C. GATE, QUAD	01295	3-60000	235
A3Z53	SN7400N	I. C. GATE, QUAD	01295	3-60000	236
A3Z54	SN7476N	I. C. FL-FL DUAL	01295	3-60070	237
A3Z55	SN7486N	I. C. EXCLUSIVE OR	01295	3-60062	238
A3Z56	SN7403N	I. C. GATE NAND	01295	3-60076	239
A3Z57	SN7420N	I. C. GATE NAND	01295	3-60012	240
A3Z58	SN7400N	I. C. GATE, QUAD	01295	3-60000	241
A3Z59	SN7400N	I. C. GATE, QUAD	01295	3-60000	242
A3Z60	SN7400N	I. C. GATE, QUAD	01295	3-60000	243
A3Z61	SN7403N	I. C. GATE NAND	01295	3-60076	244
A3Z62	SN7476N	I. C. FL-FL DUAL	01295	3-60070	245
A3Z63	SN7400N	I. C. GATE, QUAD	01295	3-60000	246

MODEL	DMM 50	CALICO P/N	200440	ASSY R.D.
TITLE	DIGITAL BOARD ASSEMBLY	SHT	9 OF 10	A3

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A3Z64	SN7400N	I. C. GATE, QUAD	01295	3-60000	247
					248
					249
					250
					251
					252
A3Y1	ER-1213	CRYSTAL 1.2 MHz	13571	2-50226	253
					254
					255
					256
					257
	8234-SS-0440-7	STANDOFF 1/4 HEX x $2^{1}/8$ LG	06540	2-10562	258
	9739-SS-0440-7	STANDOFF 1/4 HEX x 1/2 LG	06540	2-10563	259
					260
					261
					262
	253	TAPE, MYLAR .5 WIDE	99742		263
	24 GA WHT	WIRE, INS			264
					265
					266
					267
					268
					269
					270
					271
					272
					273
					274
					275
					276
					277
					278
					279
					280
					281
					282

MODEL DMM 50 | CALICO P/N 200440 | ASSY R.D. A3

TITLE DIGITAL BOARD ASSEMBLY | SHT 10 OF 10

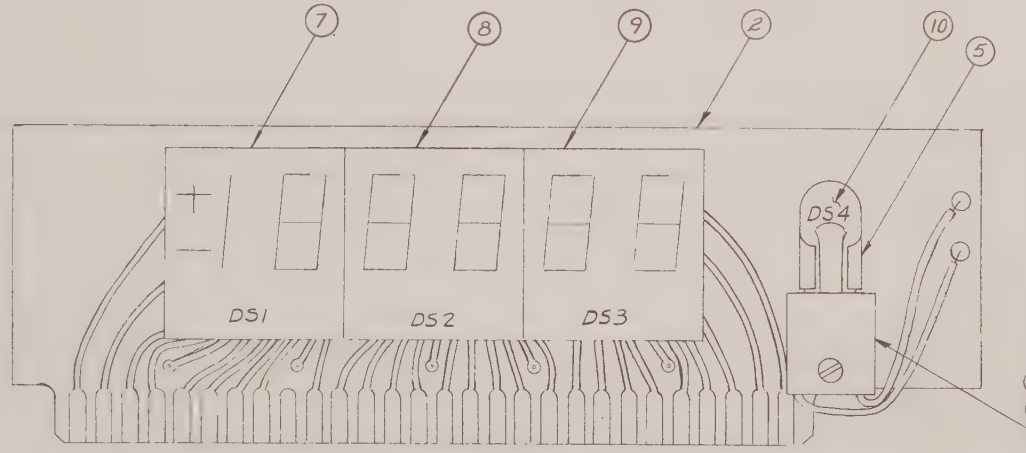
A1 ASSEMBLY

DISPLAY

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	REMOVED ITEM 3, 10 & LOCATING DIMS.	9-8-71 6-9-72	[illegible]
B	ADDED ITEMS 3, 4, 5 & GN 1	10/10/72 11-27-72	[illegible]
C	INCORPORATED ADCN # 1	2/16/73 2/7/73	[illegible]

— SEE SHEET 1.

DO NOT FLOW SOLDER
DO NOT TRIM LEADS



SECURE WITH LOCTITE # 242 (BLUE)

SEE SEPARATE PARTS LIST

ITEM NO	QTY REQD	DESCRIPTION	SCHEM DES	CIMRON PN	MIL OR VENDOR PN	CODE OR SPEC NO

LIST OF MATERIAL

NOTE: UNLESS OTHERWISE SPECIFIED
1. SOLDER ITEM 2 TO ITEM 2 USING HYDROL EP-XH. INSTALL LAMP & SHIELD PRIOR TO EPOXYING.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
FRACTIONS ± DECIMALS .X ±.030
ANGLES ± .XX ±.030
SURFACE FINISH ✓ .XXX ±.010
MATERIAL
FINISH

CONTRACT NO.
DRAWN Walt Rowlison 3/24/72
CHECKED
ENGINEER
APPROVED
APPROVED
APPROVED
CUSTOMER APPROVAL

CIMRON

BOARD ASSY-DISPLAY A1

-01	1	200900	DMM50

SIZE E | CODE IDENT NO. | DRAWING NO. 200445 | REV

94-9

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

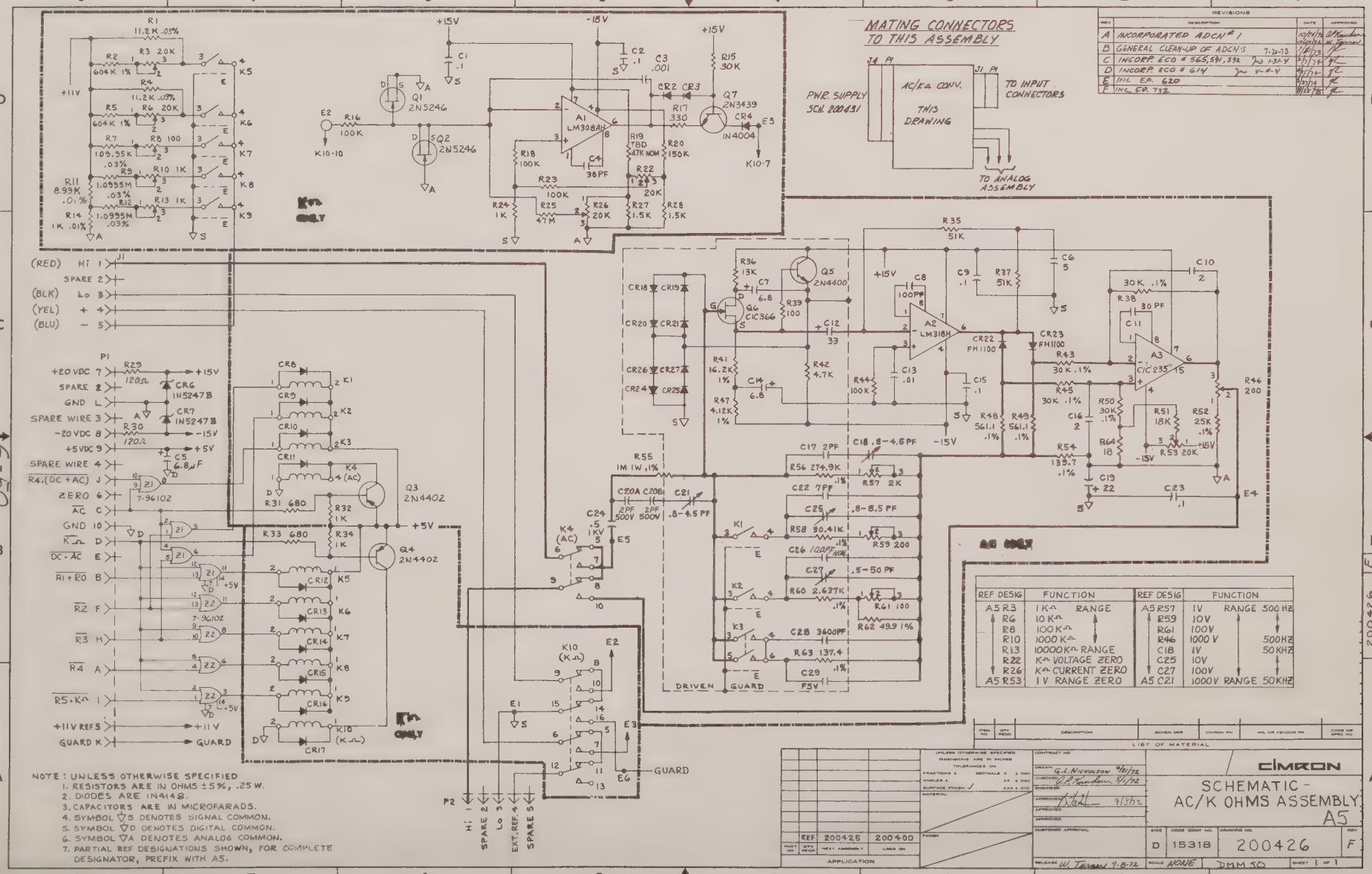
REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
	200445	ASSEMBLY	16067		
					1
	200447-01	CIRCUIT BOARD	16067	1-60224	2
XDS4	23-207	LAMP HOLDER	95263	2-50238	3
					4
	1963	LIGHT SHIELD	83330	2-50237	5
					6
DS1	SP751	INDICATOR DISPLAY	07713	2-30067	7
DS2	SP752	INDICATOR DISPLAY	07713	2-30068	8
DS3	SP752	INDICATOR DISPLAY	07713	2-30068	9
DS4	159	LAMP 6.3V .15A	03507	2-50235	10
					11
					12
	0-80UNF	HEX NUT		2-10549	13
	0-80 x 1/2 LG	SCR, RD, HD, S.S.		2-10548	14

MODEL	CALICO P/N	ASSY R.D.
DMM 50	200445	A1
TITLE DISPLAY BOARD ASSEMBLY	SHT 3 OF 3	

OPTIONAL ACCESSORY

A5 ASSEMBLY

AC/KΩ CIRCUITRY



REF DESIG	FUNCTION	REF DESIG	FUNCTION
A5 R3	1 KΩ RANGE	A5 R57	1V RANGE 500 HZ
R6	10 KΩ	R59	10V
R8	100 KΩ	R61	100V
R10	1000 KΩ	R46	1000 V 500HZ
R13	10000 KΩ RANGE	C18	1V 50 KHZ
R22	KΩ VOLTAGE ZERO	C25	10V
R26	KΩ CURRENT ZERO	C27	100V
A5 R53	1 V RANGE ZERO	A5 C21	1000V RANGE 50KHZ

LIST OF MATERIAL

ITEM NO	QTY REQD	DESCRIPTION	SCHEM DES	CIMRON PN	MIL OR VENDOR PN	CODE OR SPEC NO

REF	200425	200400
PART NO	NEXT ASSEMBLY	USED ON
APPLICATION		

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON FRACTIONS ± DECIMALS X ± .060 ANGLES ± XX ± .030 SURFACE FINISH XXX ± .010 MATERIAL

CONTRACT NO
DRAWN G.L. Nicholson 9/1/72
CHECKED D.P. Knudsen 9/1/72
ENGINEER
APPROVED 9/15/72
APPROVED
APPROVED
CUSTOMER APPROVAL
RELEASE W. Tarvin 9-18-72

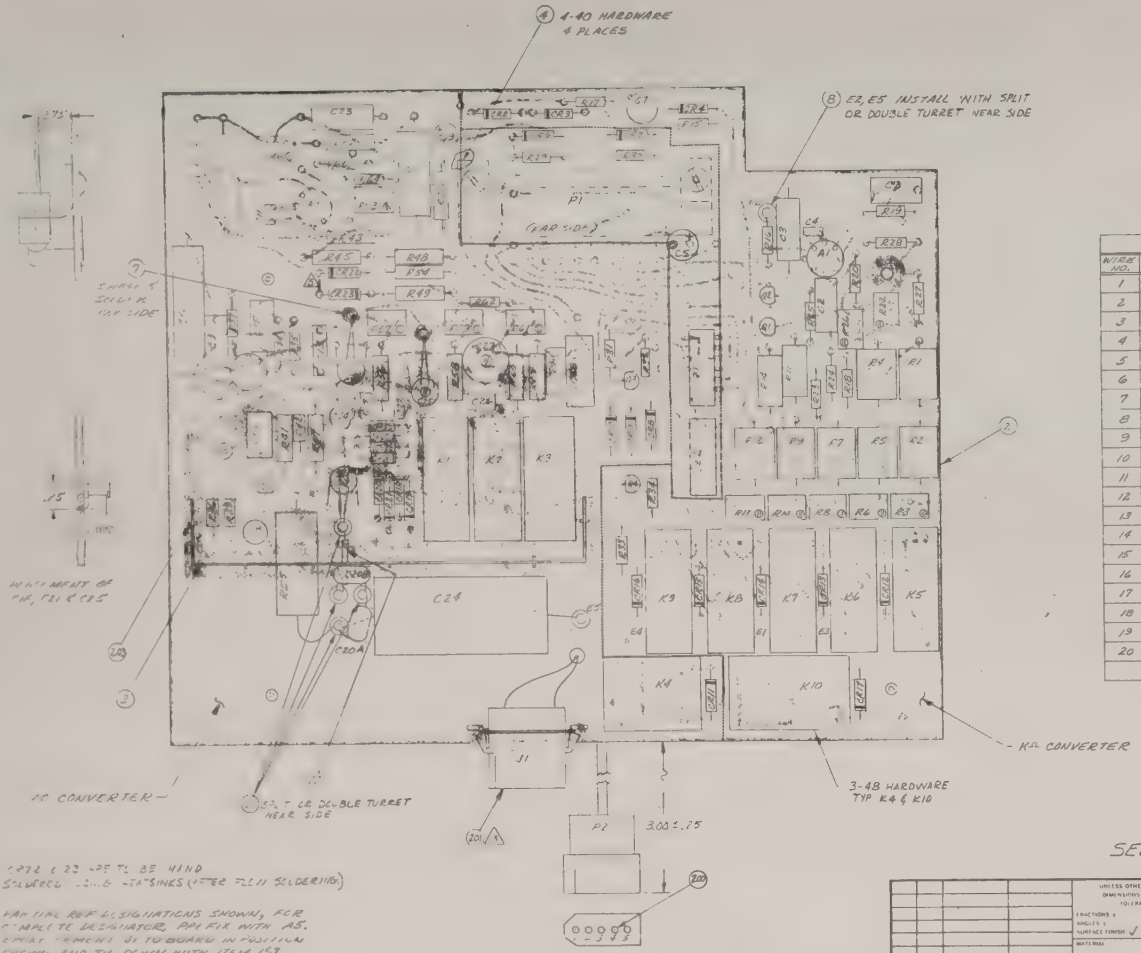
CIMRON

SCHEMATIC - AC/K OHMS ASSEMBLY A5

SIZE	CODE IDENT NO.	DRAWING NO.	REV
D	15318	200426	F

SCALE NONE DMM 30 SHEET 1 OF 1

200426 E



REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
B	REDRAWN & REDESIGNED	8/7/72	J. Hartley
C	INCORPORATED A...	9/7/72	J. Hartley
D	SEE SHT 1		

WIRING TABLE

WIRE NO.	ITEM NO.	FROM	TO	TO	TO
1	107	J1-1	K4-6	K4-6	E2-1
2		J1-3	K10-9	P2-3	
3		J1-4	K10-6	E2-4	K10-6
4		J1-5	K9-4	—	K9-4
5		K9-4	K8-4		
6		K8-4	K7-4	—	
7		K7-4	K6-4		
8		K6-4	K5-4	—	
9		P2-1	K4-3	K4-3	—
10		P2-3	K10-15	—	
11		K10-15	E1 PAD	—	E1 PAD
12		P2-4	K10-12	—	K10-12
13		K4-5	K4-8	K4-8	—
14		K4-7	E5 TERM	E5 TERM	—
15		K4-10	E4 PAD	E4 PAD	—
16		K10-8	K10-14		
17		K10-10	E2 TERM	—	E2 TERM
18		K10-5	K10-11	—	K10-11
19		K10-7	E3 PAD	—	E3 PAD
20	107	K10-16	E6 PAD	—	E6 PAD

SEE SEPARATE PARTS LIST

1. C22 & 23 ARE TL 85 MIND SOLDERED ... LEADS (AFTER FINAL SOLDERING)
2. MATERIAL REF DESIGNATIONS SHOWN, FOR COMPLETE DESIGNATOR, PREFIX WITH A5. (HEAT REMOVAL J1 TO BOARD IN POSITION SHOWN AND TIE DOWN WITH ITEM 107.
3. ALL RESISTORS ARE 5% .25W.
4. REF SCHEMATIC NO. 200426.

NOTES UNLESS OTHERWISE SPECIFIED

PART NO	QTY	NEXT ASSEMBLY	USED ON
-03	AR	200400	DMM50
-02	AR	200400	DMM50
-01	AR	200400	DMM50

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS ± DECIMALS .X ± .050, .XX ± .030, .XXX ± .010, ANGLES ±, SURFACE FINISH √, MATERIAL, FINISH

DRAWN G. Hanson 9/1/72
CHECKED R.D. Knutson 9/1/72
ENGINEER
APPROVED
APPROVED J. Wiegland 9/1/72
APPROVED
CUSTOMER APPROVAL
RELEASE M.J. Turner 9/1/72

CIMRON DIVISION

BOARD ASSEMBLY-AC/KOMA

A5

SIZE D | CODE IDENT NO 15318 | DRAWING NO 200425 | REV D | SCALE 2:1 | SHEET 2

200425

CALIFORNIA INSTRUMENTS CO. SAN DIEGO, CALIFORNIA	CODE IDENT 16067	PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A5-01	200425-01	AC/KΩ ASSY	16067	OPTION 04	
A5-02	200425-02	AC ASSY	16067	OPTION 02	
A5-03	200425-03	KΩ ASSY	16067	OPTION 03	
					1
	200427-02	P.C. BOARD	16067	1-60219	2
	200428-01	SHIELD	16067	1-10476	3
	200434-01	BRACKET	16067	1-10477	4
	200429-01	SHIELD	16067	1-10478	5
	RST-2-SM-1160SL	TERM. INS.	98291	2-50228	6
	1028-2	TERM. TURRET SLOT.	71279	2-50229	7
	FT-2-SM-1164SL	TERM. INS F/T	98291	2-50227	8
					9
A5A1	LM308AH	OPERATIONAL AMP	27014	3-60044	10
A5A2	LM318H	OPERATIONAL AMP	27014	3-60033	11
A5A3	CIC 235	OPERATIONAL AMP	16067	3-60083	12
					13
					14
					15
A5C1	C280AE/A100K	CAPACITOR .1μF 250V	73445	6-10916	16
A5C2	C280AE/A100K	CAPACITOR .1μF 250V	73445	6-10916	17
A5C3	SX210	CAPACITOR 1000pF 600V	90201	6-10910	18
A5C4	DM5EC300J	CAPACITOR 30pF 300V	72136	6-10952	19
A5C5	T362B685M015AS	CAPACITOR 6.8μF 15V	05397	6-10953	20
A5C6	M1A-505	CAPACITOR 5μF 100V	12406	6-10959	21
A5C7	T362B685M015AS	CAPACITOR 6.8μF 15V	05397	6-10953	22
A5C8	DM5FC101J	CAPACITOR 100pF 300V	72136	6-10954	23
A5C9	C280AE/A100K	CAPACITOR .1μF 250V	73445	6-10916	24
A5C10	C5A205J	CAPACITOR 2μF 50V	12406	6-10942	25
A5C11	DM5EC300J	CAPACITOR 30pF 300V	72136	6-10952	26
A5C12	T362B336M010AS	CAPACITOR 33μF 10V	05397	6-10751	27
A5C13	C280AE/A10K	CAPACITOR .01μF 250V	73445	6-10929	28
A5C14	T362B685M015AS	CAPACITOR 6.8μF 15V	05397	6-10953	29
A5C15	C280AE/A100K	CAPACITOR .1μF 250V	73445	6-10916	30

MODEL DMM50	CALICO P/N 200425		ASSY R.D.
TITLE OPTIONS 02, 03 and 04 AC/KΩ ASSEMBLY		SHT 3 OF 8	A5

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A5C16	C5A205J	CAPACITOR 2μF 50V	12406	6-10942	31
A5C17	DM10-020D	CAPACITOR 2pF 500V	72136	6-10001	32
A5C18	561-013	CAPACITOR TRIM .8-4.5pF	72982	6-10909	33
A5C19	T362B226M015AS	CAPACITOR 22μF 15V	05397	6-10967	34
A5C20A	DM10-020D	CAPACITOR 2pF 500V	72136	6-10001	35
A5C20B	DM10-020D	CAPACITOR 2pF 500V	72136	6-10001	36
A5C21	561-013	CAPACITOR TRIM .8-4.5pF	72982	6-10909	37
A5C22	DM5CC070K	CAPACITOR 7pF 300V	72136	6-10968	38
A5C23	210B1B104	CAPACITOR .1μF 50V	14752	6-10969	39
A5C24	ZA2J504K	CAPACITOR .5μF 1000V	27556	6-10915	40
A5C25	563-013	CAPACITOR TRIM .8-8.5pF	72982	6-10918	41
A5C26	DM5FC101J	CAPACITOR 100pF 300V	72136	6-10954	42
A5C27	HT10MA/550	CAPACITOR TRIM .5-50pF	73445	6-10919	43
A5C28	DM19-362J	CAPACITOR 3600pF 500V	72136	6-10729	44
A5C29	DM15	CAPACITOR TBD 300V	72136	--	45
					46
					47
					48
					49
					50
					51
A5CR1	NOT USED				52
A5CR2	1N4148	DIODE	25403	3-10227	53
A5CR3	1N4148	DIODE	25403	3-10227	54
A5CR4	1N4004	DIODE	81349	3-10062	55
A5CR5	NOT USED				56
A5CR6	1N5247B	DIODE ZENER	81349	3-10243	57
A5CR7	1N5247B	DIODE ZENER	81349	3-10243	58
A5CR8	1N4148	DIODE	25403	3-10227	59
A5CR9	1N4148	DIODE	25403	3-10227	60
A5CR10	1N4148	DIODE	25403	3-10227	61
A5CR11	1N4148	DIODE	25403	3-10227	62
A5CR12	1N4148	DIODE	25403	3-10227	63
A5CR13	1N4148	DIODE	25403	3-10227	64
A5CR14	1N4148	DIODE	25403	3-10227	65
A5CR15	1N4148	DIODE	25043	3-10227	66

MODEL DMM50 | CALICO P/N 200425 | ASSY R.D. A5

TITLE OPTIONS 02, 03 and 04 AC/KΩ ASSEMBLY | SHT 4 OF 8

CALIFORNIA INSTRUMENTS CO. SAN DIEGO, CALIFORNIA	CODE IDENT 16067	PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A5CR16	1N4148	DIODE	25403	3-10227	67
A5CR17	1N4148	DIODE	25403	3-10227	68
A5CR18	1N4148	DIODE	25403	3-10227	69
A5CR19	1N4148	DIODE	25403	3-10227	70
A5CR20	1N4148	DIODE	25403	3-10227	71
A5CR21	1N4148	DIODE	25403	3-10227	72
A5CR22	FH1100	DIODE	07263	3-10212	73
A5CR23	FH1100	DIODE	07263	3-10212	74
A5CR24	1N4148	DIODE	25403	3-10227	75
A5CR25	1N4148	DIODE	25403	3-10227	76
A5CR26	1N4148	DIODE	25403	3-10227	77
A5CR27	1N4148	DIODE	25403	3-10227	78
					79
					80
					81
A5K1	214-00003	RELAY REED	31951	2-45126	82
A5K2	214-00003	RELAY REED	31951	2-45126	83
A5K3	214-00008	RELAY REED	31951	2-45127	84
A5K4	R10-E1-Z2-S200	RELAY 2 FORM C	24796	2-45134	85
A5K5	214-00003	RELAY REED	31951	2-45126	86
A5K6	214-00003	RELAY REED	31951	2-45126	87
A5K7	214-00003	RELAY REED	31951	2-45126	88
A5K8	214-00003	RELAY REED	31951	2-45126	89
A5K9	214-00003	RELAY REED	31951	2-45126	90
A5K10	R10-E1-Z4-S110	RELAY 4 FORM C	24796	2-45133	91
					92
					93
					94
					95
A5J1	1625-5-R	RECEPTACLE	27264	4-10220	96
					97
A5P1	225-21021-105	PLUG 10 PIN RIGHT ANG.	02660	4-10223	98
A5P2	1625-5-P-1	PLUG, 5 PIN	27264	4-10224	99
					100
					101
					102

MODEL DMM50	CALICO P/N 200425		ASSY R.D. A5
TITLE OPTIONS 02, 03, and 04 AC/KΩ ASSEMBLY		SHT 5 OF 8	

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A5Q1	2N5246	TRANSISTOR FET	01295	3-30243	103
A5Q2	2N5246	TRANSISTOR FET	01295	3-30243	104
A5Q3	2N4402	TRANSISTOR PNP	81349	3-30259	105
A5Q4	2N4402	TRANSISTOR PNP	81349	3-30259	106
A5Q5	2N4400	TRANSISTOR NPN	81349	3-30257	107
A5Q6	CIC 366	TRANSISTOR FET	16067	3-30283	108
A5Q7	2N3439	TRANSISTOR	81349	3-30244	109
					110
					111
					112
					113
					114
A5R1	TYPE OD	RESISTOR 11.2K .03% .33W	07088	5-80358	115
A5R2	NA60	RESISTOR 604K 1% 1/4W	07115	5-60676	116
A5R3	3299W-1-203	POTENTIOMETER 20K	80294	5-70226	117
A5R4	TYPE OD	RESISTOR 11.2K .03% .33W	07088	5-80358	118
A5R5	NA60	RESISTOR 604K 1% 1/4W	07115	5-60676	119
A5R6	3299W-1-203	POTENTIOMETER 20K	80294	5-70226	120
A5R7	TYPE OD	RESISTOR 109.95K .03% .33W	07088	5-80362	121
A5R8	3299W-1-101	POTENTIOMETER 100Ω	80294	5-70225	122
A5R9	TYPE OD	RESISTOR 1.0995M .03% .33W	07088	5-80359	123
A5R10	3299W-1-102	POTENTIOMETER 1K	80294	5-70218	124
A5R11	TYPE OB	RESISTOR 8.99K .01% 1/4W	07088	5-80360	125
A5R12	TYPE OB	RESISTOR 1.0995M .03% .33W	07088	5-80359	126
A5R13	3299W-1-102	POTENTIOMETER 1K	80294	5-70218	127
A5R14	TYPE OB	RESISTOR 1K .01% 1/4W	07088	5-80361	128
A5R15	RC07GF303J	RESISTOR 30K 5% 1/4W	81349	5-10087	129
A5R16	RC07GF104J	RESISTOR 100K 5% 1/4W	81349	5-10100	130
A5R17	RC07GF331J	RESISTOR 330Ω 5% 1/4W	81349	5-10041	131
A5R18	RC07GF104J	RESISTOR 100K 5% 1/4W	81349	5-10100	132
A5R19	RC07GF473J	RESISTOR 47K 5% 1/4W	81349	5-10092	133
A5R20	RC07GF154J	RESISTOR 150K 5% 1/4W	81349	5-10104	134
A5R21	NOT USED				135
A5R22	3299W-1-203	POTENTIOMETER 20K	80294	5-70226	136
A5R23	RC07GF104J	RESISTOR 100K 5% 1/4W	81349	5-10100	137
A5R24	RC07GF102J	RESISTOR 1K 5% 1/4W	81349	5-10053	138

MODEL DMM50 | CALICO P/N 200425 | ASSY R.D. A5

TITLE OPTIONS 02, 03 and 04 AC/KΩ ASSEMBLY | SHT 6 OF 8

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A5R25	RC07GF476J	RESISTOR 47M 5% 1/4W	81349	5-10161	139
A5R26	3299W-1-203	POTENTIOMETER 20K	80294	5-70226	140
A5R27	RC07GF152J	RESISTOR 1.5K 5% 1/4W	81349	5-10057	141
A5R28	RC07GF152J	RESISTOR 1.5K 5% 1/4W	81349	5-10057	142
A5R29	RC07GF121J	RESISTOR 120Ω 5% 1/4W	81349	5-10031	143
A5R30	RC07GF121J	RESISTOR 120Ω 5% 1/4W	81349	5-10031	144
A5R31	RC07GF681J	RESISTOR 680Ω 5% 1/4W	81349	5-10049	145
A5R32	RC07GF102J	RESISTOR 1K 5% 1/4W	81349	5-10053	146
A5R33	RC07GF681J	RESISTOR 680Ω 5% 1/4W	81349	5-10049	147
A5R34	RC07GF102J	RESISTOR 1K 5% 1/4W	81349	5-10053	148
A5R35	RC07GF513J	RESISTOR 51K 5% 1/4W	81349	5-10093	149
A5R36	RC07GF133J	RESISTOR 13K 5% 1/4W	81349	5-10079	150
A5R37	RC07GF513J	RESISTOR 51K 5% 1/4W	81349	5-10093	151
A5R38	PME-65	RESISTOR 30K .1% 1/4W	03888	5-80307	152
A5R39	RC07GF101J	RESISTOR 100Ω 5% 1/4W	81349	5-10029	153
A5R40	NOT USED				154
A5R41	RN60D1622F	RESISTOR 16.2K 1% 1/4W	81349	5-60094	155
A5R42	RC07GF472J	RESISTOR 4.7K 5% 1/4W	81349	5-10068	156
A5R43	PME-65	RESISTOR 30K .1% 1/4W	03888	5-80307	157
A5R44	RC07GF104J	RESISTOR 100K 5% 1/4W	81349	5-10100	158
A5R45	PME-65	RESISTOR 30K .1% 1/4W	03888	5-80307	159
A5R46	3299W-1-201	POTENTIOMETER 200Ω	80294	5-70228	160
A5R47	RN60D4121F	RESISTOR 4.12K 1% 1/4W	81349	5-60339	161
A5R48	PME-65	RESISTOR 561.1Ω .1% 1/4W	03888	5-80309	162
A5R49	PME-65	RESISTOR 561.1Ω .1% 1/4W	03888	5-80309	163
A5R50	PME-65	RESISTOR 30K .1% 1/4W	03888	5-80307	164
A5R51	RC07GF183J	RESISTOR 18K 5% 1/4W	81349	5-10082	165
A5R52	PME-65	RESISTOR 25K .1% 1/4W	03888	5-80308	166
A5R53	3299W-1-203	POTENTIOMETER 20K	80294	5-70226	167
A5R54	PME-65	RESISTOR 139.7Ω .1% 1/4W	03888	5-80310	168
A5R55	PME75T9	RESISTOR 1M .1% 1/4W	03888	5-80305	169
A5R56	PME-65	RESISTOR 274.9K .1% 1/4W	03888	5-80347	170
A5R57	3299W-1-202	POTENTIOMETER 2K	80294	5-70227	171
A5R58	PME-65	RESISTOR 30.41K .1% 1/4W	03888	5-80366	172
A5R59	3299W-1-201	POTENTIOMETER 200Ω	80294	5-70228	173
A5R60	PME-65	RESISTOR 2.637K .1% 1/4W	03888	5-80312	174

MODEL DMM50 | CALICO P/N 200425 | ASSY R.D. A5

TITLE OPTION 02, 03, and 04 AC/KΩ ASSEMBLY | SHT 7 OF 8

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A5R61	3299W-1-101	POTENTIOMETER 100Ω	80294	5-70225	175
A5R62	RN55C49R9F	RESISTOR 49.9Ω 1% 1/8W	81349	5-60670	176
A5R63	PME-65	RESISTOR 137.4Ω .1% 1/4W	03888	5-80348	177
A5R64	RC07GF180J	RESISTOR 18Ω 5% 1/4W	81349	5-10011	178
					179
					180
					181
					182
					183
					184
					185
A5Z1	SN7432N	I.C. GATE	01295	3-60064	186
A5Z2	SN7432N	I.C. GATE	01295	3-60064	187
					188
					189
					190
					191
					192
					193
					194
					195
					196
	24GA WHT	WIRE INS 1000V			197
					198
					199
	1560	PIN TERM MALE	27264	4-10225	200
	1561	PIN TERM FEMALE	27264	4-10221	201
					202
	5201-0223	PIN CONNECTOR	91662	4-10217	203
					204
					205
					206
					207
					208
					209
					210

MODEL DMM50 | CALICO P/N 200425 | ASSY R.D. A5

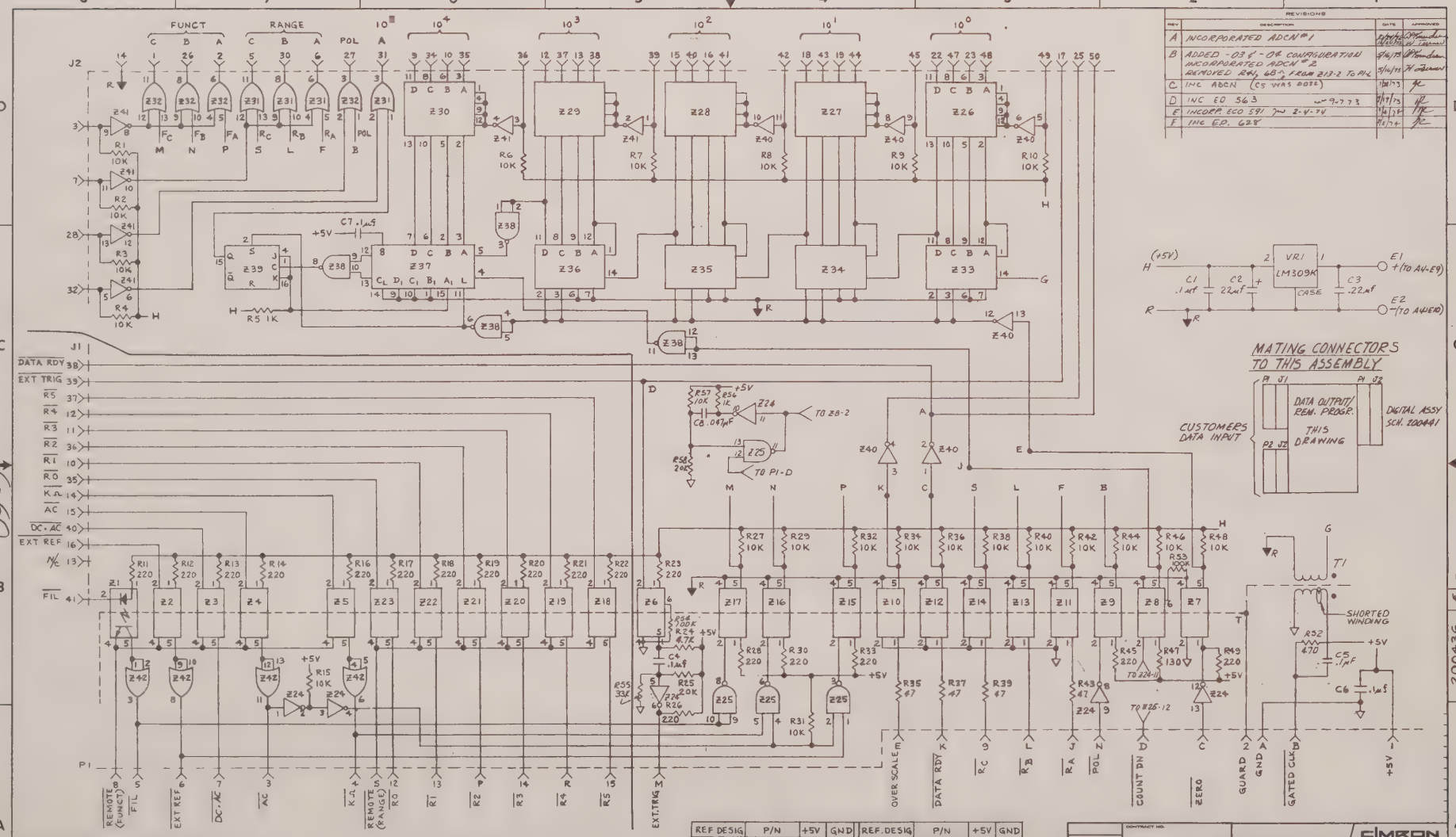
TITLE OPTIONS 02, 03, and 04 AC/KΩ ASSEMBLY | SHT 8 OF 8

OPTIONAL ACCESSORY

A2 ASSEMBLY

DATA OUTPUT/REMOTE

PROGRAMMING CIRCUITRY



REV	DESCRIPTION	DATE	APPROVED
A	INCORPORATED ADCN #1	5/14/73	
B	ADDED -03 & -04 CONFIGURATION INCORPORATED ADCN #2 REMOVED R41, 68Ω FROM Z13-2 TO P1-L	5/14/73	
C	INC ADCN (CS WAS 0078)	7/31/73	
D	INC EO 563	9-7-73	
E	INCORP. ECO 591	2-V-74	
F	INC E.O. 628	9/3/74	

NOTE: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE IN OHMS, ±5%, .25W.
2. PARTIAL REF. DESIGNATIONS SHOWN, FOR COMPLETE DESIGNATOR, PREFIX WITH A2.

REF DESIG	P/N	+5V	GND	REF. DESIG	P/N	+5V	GND
Z1-223	MCTZ	—	—	Z37	SN74192N	16	8
Z24	SN7405N	14	7	Z38	SN7400N	14	7
Z25	SN*403N	14	7	Z39	SN7476N	5	13
Z26-32,42	MC1808P	14	7	Z40,41	SN7404N	14	7
Z33-36	SN7490N	5	10			—	—

CIMRON DIVISION

SCHEMATIC - DATA OUTPUT/ A2 REMOTE PROGRAMMING

SIZE	CODE IDENT NO.	DRAWING NO.	REV
D	15318	200436	F

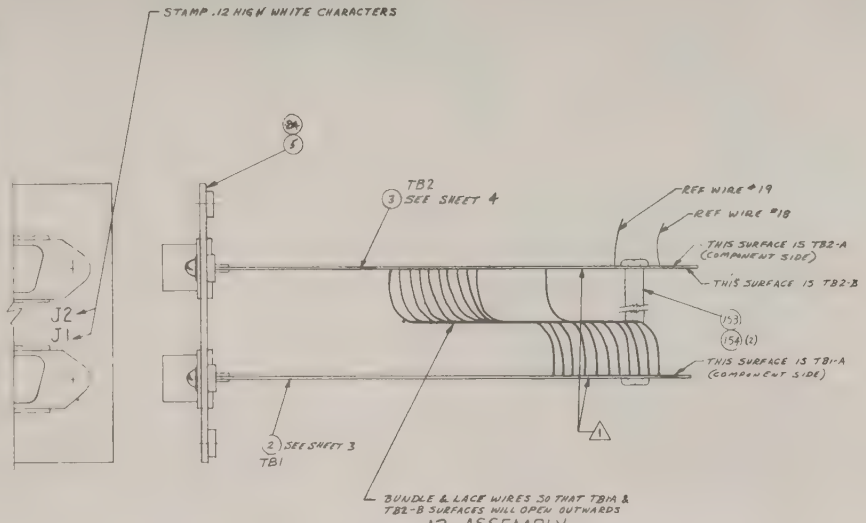
DRAWN: G.L. NICHOLSON 9/18/72
CHECKED:
ENGINEER:
APPROVED:
CUSTOMER APPROVAL:
USED ON APPLICATION: 200400
SCALE: NONE
RELEASE:
SHEET 1 OF 1

200436 F

09-9

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	INC. ADCNS 1 & 2	3/1/72	W. Hansen
B	ADDED -03 & 04 CONFIGURATIONS ADDED SUPERSEDURE NOTES ADDED SHEET # ON SHT 2, ADDED R35, 37, 39 & 43. SEE SHT 1	3/24/72 6/14/72	A Hansen G Nicholson

WIRING TABLE			
WIRE NO	ITEM NO	FROM	TO
	67	TB1-A PAD A	TB2-B PAD A
2			B
3			C
4			D
5			E
6			F
7	#2		G
8	#61		H
9	#2		J
10			K
11			L
12			M
13			N
14	#1		P
15	#61		R
16	#62		S
17	61	TB1-A-PAD T	TB2-B PAD T
18	64	TB2-A-PAD E	N. CONN. 4 IN.
19	#63	TB2-A-PAD E2	N.C. CONN. 4 IN.



A2 ASSEMBLY

A2-01 CONFIG. SHOWN
A2-02 CONFIG. SAME AS -01 EXCEPT ON TB1,
OMIT Z1-Z5, Z18-Z23, Z42 & XZ42.
OMIT R11-R14 & R16-R22

NOTE: UNLESS OTHERWISE SPECIFIED
⚠ STAMP APPLICABLE DASH NO.

SEE SEPARATE PARTS LIST

APPLICATION			
-02	A/R	200400	DMM50
01	A/R	200400	DMM50

OMRON

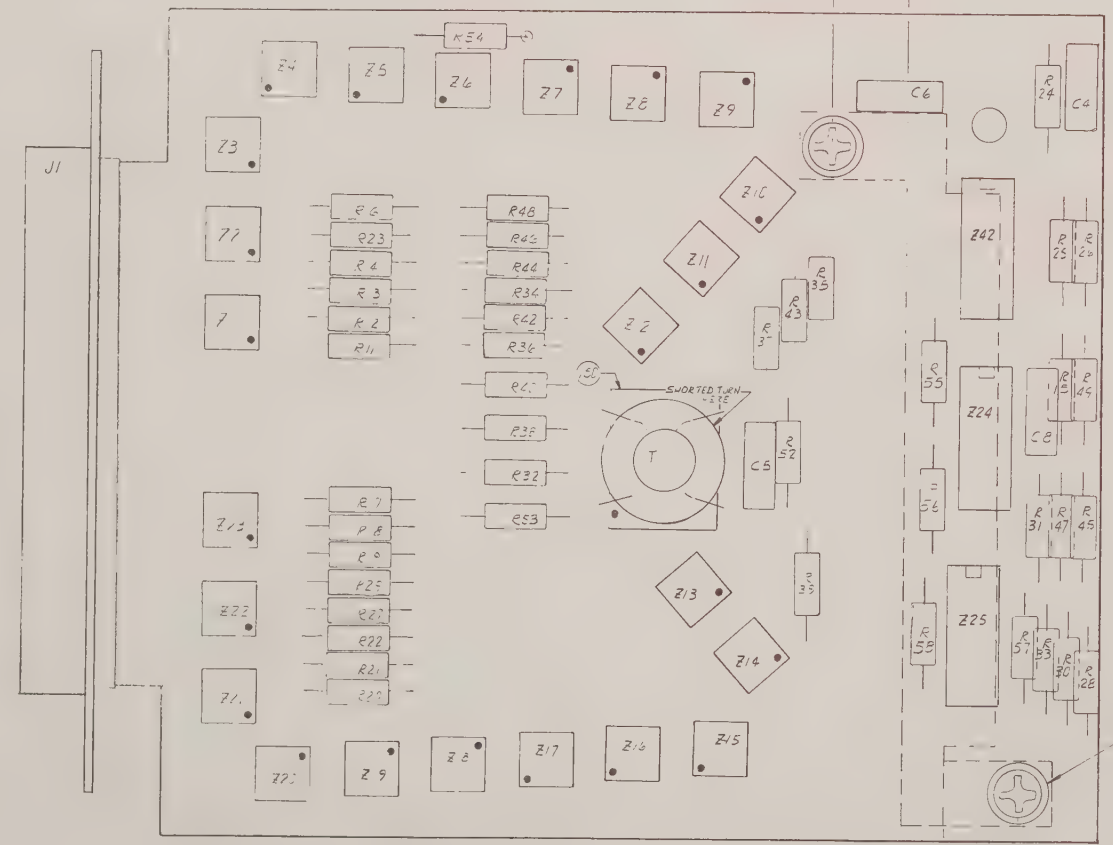
ASSEMBLY~ A2
DATA OUTPUT/
REMOTE PROGRAMMING

D | 15318 | 200435 | F

SHEET 2 - 4

19-5

200435 F



TB1-01 BOARD ASSY

(CLAD SHOWN IS FAR SIDE)

TB1-02 SAME AS ABOVE EXCEPT OMIT Z1 → Z5, Z18 → Z23, Z42 & XZ42; OMIT R11 → R14, & R16 → R22

2. FOR SCHEMATIC DIAGRAM, SEE DWG D200436.
1. DOT ON IC'S INDICATES PIN 1.

NOTES (UNLESS OTHERWISE SPECIFIED)

REVISIONS

REV	AUTH	DESCRIPTION	ZONE	EFF ON	DATE	APRD

REQD PER ASSY	ITEM NO.	PART NUMBER	PART NAME	MATERIAL — SPECIFICATION	CODE IDENT	FINISH	REF DES	ZONE
			BD ASSY	SEE PL SHEETS 5 → 9				

DIM. IN INCHES TOLERANCES XXX = .000, XX = .03, X = .30

BREAK ALL SHARP CORNERS & EDGES MACH SURFACES ✓

DWG SIZE D

EXCEPT AS OTHERWISE PROVIDED BY CONTRACT, THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY OF CALICO AND SHALL NOT BE REPRODUCED OR COPIED OR USED AS THE BASIS FOR THE MANUFACTURE OR SALE OF APPARATUS WITHOUT WRITTEN PERMISSION

TITLE: PC BOARD ASSEMBLY DATA OUTPUT / REMOTE PROG. -TB1- A2

MODEL DVM 50 (OPTION-07, -08)

CALICO — CALIFORNIA INSTRUMENTS CORP. SAN DIEGO, CALIFORNIA

CONTRACT NO. — CODE IDENT 16067

RELEASE — CHECKER — PURCHASING — DESIGN — PROJ ENGR — CHF ENGR — CHF SIGN: H. Murphy 2/16-77

DWG NO. 200435 REV H

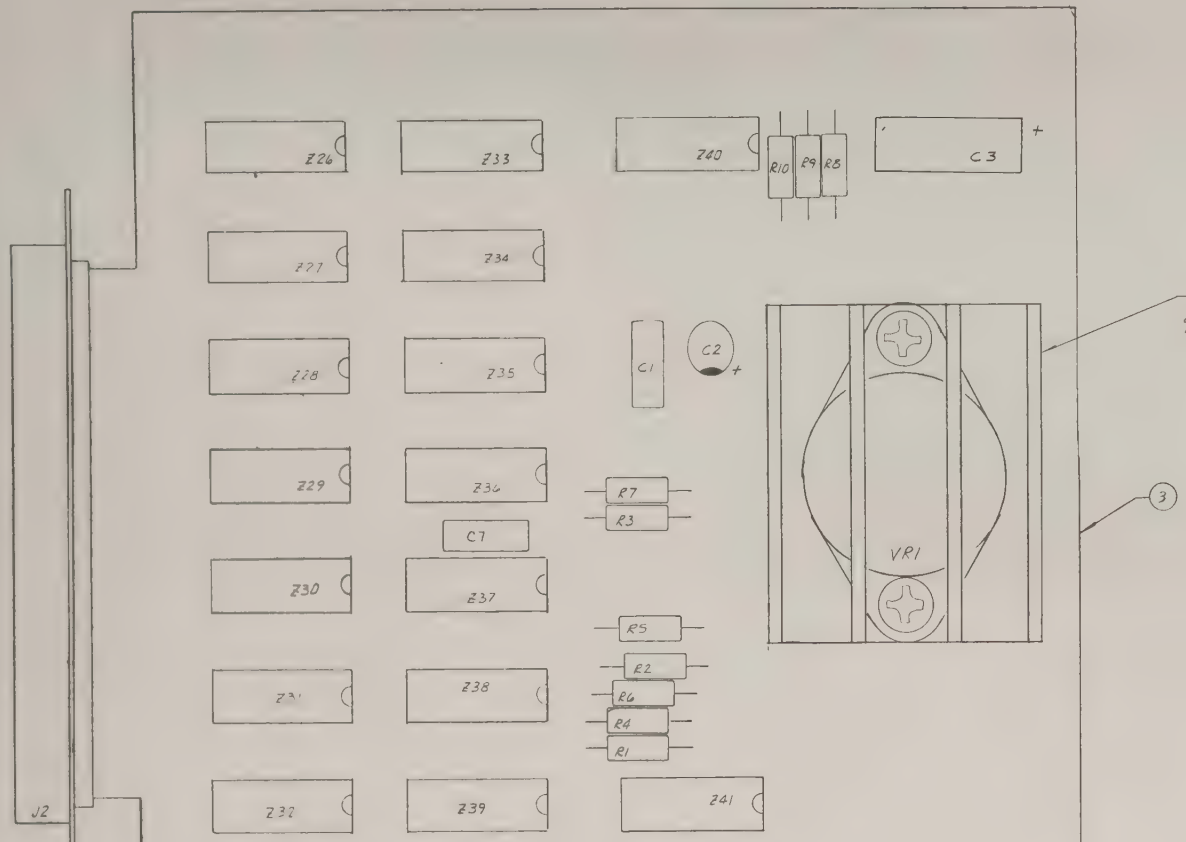
SCALE 2X SHEET 7 OF 9

DASH NO.	QTY. REQD.	NEXT ASSEMBLY	EFF ON	AUTH
-02	1	200400	OPTION 07	
-0	1	200430	OPTION 08	

200435 H

2-23-77

REVISIONS						
REV	AUTH	DESCRIPTION	ZONE	EFF ON	DATE	APRD
		SEE SHEET 1				



6-63/64

TB2 BOARD ASSY

CLAD SHOWN IS CLAD SIDE
(TB2-01 & TB2-02 ASSEMBLIES ARE IDENTICAL ON THIS ASSY)

1. FOR SCHEMATIC DIAGRAM, SEE DWG D200836

NOTES: (UNLESS OTHERWISE SPECIFIED)

ITEM NO	PART NUMBER	PART NAME	MATERIAL — SPECIFICATION	CODE IDENT	FINISH	REF DES	ZONE
REQD PER ASSY		BD ASSY	SEE PL SHEETS 5 → 9				

DASH NO	QTY REQD	NEXT ASSEMBLY	EFF ON	AUTH
-02	1	200400	OPTION 07	
-01	1	200400	OPTION 08	

DIM IN INCHES
TOLERANCES
XXX = .010
XX = .03
X° = 30'

BREAK ALL SHARP CORNERS & EDGES
MACH SURFACES √

DWG SIZE D

TITLE: P.C. BOARD ASSY
DATA OUTPUT/REMOTE PROG -TB2- A2
MODEL: DMM50 (OPTION 07, -08)
RELEASE
CHECKER
DESIGN
DRFTSMN M Marcum 9-7-73
PURCHASING
PROJ ENGR
CHF ENGR

CALIFORNIA INSTRUMENTS CORP
SAN DIEGO, CALIFORNIA
CONTRACT NO
CODE IDENT 16067
DWG NO 200435
REV F
SCALE 4X
SHEET 4 OF 9

200435 F

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CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A2-01	200435-01	BCD/PROG ASSY	16067	OPTION 08	
A2-02	200435-02	BCD ASSY	16067	OPTION 07	
					1
TB1	200437-02	LOWER P.C. BOARD	16067	1-60221	2
TB2	200438-02	UPPER P.C. BOARD	16067	1-60222	3
	200434-02	RIGHT ANGLE BKT	16067	1-10480	4
	200439-01	CONN. MTG. PLATE	16067	1-10481	5
A2T1	200494-01	TRANSFORMER	16067	7-10263	6
					7
					8
					9
					10
A2C1	C280AE/A100K	CAPACITOR .1μF 250V	73445	6-10916	11
A2C2	T362B226M015AS	CAPACITOR 22μF 15V	05397	6-10967	12
A2C3	C280AE/A220K	CAPACITOR .22μF 250V	73445	6-10881	13
A2C4	C280AE/A100K	CAPACITOR .1μF 250V	73445	6-10916	14
A2C5	C280AE/A100K	CAPACITOR .1μF 250V	73445	6-10916	15
A2C6	C280AE/A100K	CAPACITOR .1μF 250V	73445	6-10916	16
A2C7	C280AE/A100K	CAPACITOR .1μF 250V	73445	6-10916	17
A2C8	C280AE/A47K	CAPACITOR .047μF	73445	6-10970	18
					19
					20
					21
A2J1	57-40500	RECEPTACLE	02660	4-10024	22
A2J2	57-40506	RECEPTACLE	02660	4-10024	23
	57-30500	PLUG (MATES WITH J1 and J2)	02660	4-10022	24
					25
					26
A2P1	225-21521-105	CONN. P.C. RIGHT ANGLE	02660	4-1022[illegible]	27
					28
					29
					30

MODEL DMM50 | CALICO P/N 200435 | ASSY R.D. A2

TITLE OPTION 07 and 08 BCD/PROG ASSY (A2) | SHT 5 OF 9

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A2R1	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	31
A2R2	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	32
A2R3	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	33
A2R4	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	34
A2R5	RC07GF102J	RESISTOR 1K 5% 1/4W	81349	5-10053	35
A2R6	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	36
A2R7	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	37
A2R8	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	38
A2R9	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	39
A2R10	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	40
A2R11	RC07GF221J	RESISTOR 220Ω 5% 1/4W	81349	5-10037	41
A2R12	RC07GF221J	RESISTOR 200Ω 5% 1/4W	81349	5-10037	42
A2R13	RC07GF221J	RESISTOR 220Ω 5% 1/4W	81349	5-10037	43
A2R14	RC07GF221J	RESISTOR 220Ω 5% 1/4W	81349	5-10037	44
A2R15	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	45
A2R16	RC07GF221J	RESISTOR 220Ω 5% 1/4W	81349	5-10037	46
A2R17	RC07GF221J	RESISTOR 220Ω 5% 1/4W	81349	5-10037	47
A2R18	RC07GF221J	RESISTOR 220Ω 5% 1/4W	81349	5-10037	48
A2R19	RC07GF221J	RESISTOR 220Ω 5% 1/4W	81349	5-10037	49
A2R20	RC07GF221J	RESISTOR 220Ω 5% 1/4W	81349	5-10037	50
A2R21	RC07GF221J	RESISTOR 220Ω 5% 1/4W	81349	5-10037	51
A2R22	RC07GF221J	RESISTOR 220Ω 5% 1/4W	81349	5-10037	52
A2R23	RC07GF221J	RESISTOR 220Ω 5% 1/4W	81349	5-10037	53
A2R24	RC07GF472J	RESISTOR 4.7K 5% 1/4W	81349	5-10068	54
A2R25	RC07GF203J	RESISTOR 20K 5% 1/4W	81349	5-10083	55
A2R26	RC07GF221J	RESISTOR 220Ω 5% 1/4W	81349	5-10037	56
A2R27	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	57
A2R28	RC07GF221J	RESISTOR 220Ω 5% 1/4W	81349	5-10037	58
A2R29	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	59
A2R30	RC07GF221J	RESISTOR 220Ω 5% 1/4W	81349	5-10037	60
A2R31	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	61
A2R32	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	62
A2R33	RC07GF221J	RESISTOR 220Ω 5% 1/4W	81349	5-10037	63
A2R34	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	64
A2R35	RC07GF470J	RESISTOR 47Ω 5% 1/4W	81349	5-10021	65
A2R36	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	66

MODEL DMM50 | CALICO P/N 200435 | ASSY R.D. A2

TITLE OPTION 07 and 08 BCD/PROG ASSY | SHT 6 OF 9

CALIFORNIA INSTRUMENTS CO. SAN DIEGO, CALIFORNIA	CODE IDENT 16067	PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A2R37	RC07GF470J	RESISTOR 47Ω 5% 1/4W	81349	5-10021	67
A2R38	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	68
A2R39	RC07GF470J	RESISTOR 47Ω 5% 1/4W	81349	5-10021	69
A2R40	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	70
A2R41	NOT USED				71
A2R42	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	72
A2R43	RC07GF470J	RESISTOR 47Ω 5% 1/4W	81349	5-10021	73
A2R44	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	74
A2R45	RC07GF221J	RESISTOR 220Ω 5% 1/4W	81349	5-10037	75
A2R46	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	76
A2R47	RC07GF131J	RESISTOR 130Ω 5% 1/4W	81349	5-10032	77
A2R48	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	78
A2R49	RC07GF221J	RESISTOR 220Ω 5% 1/4W	81349	5-10037	79
A2R50	NOT USED				80
A2R51	NOT USED				81
A2R52	RC07GF471J	RESISTOR 470Ω 5% 1/4W	81349	5-10045	82
A2R53	RC07GF104J	RESISTOR 100K 5% 1/4W	81349	5-10100	83
A2R54	RC07GF104J	RESISTOR 100K 5% 1/4W	81349	5-10100	84
A2R55	RC07GF333J	RESISTOR 33K 5% 1/4W	81349	5-10088	85
A2R56	RC07GF102J	RESISTOR 1K 5% 1/4W	81349	5-10053	86
A2R57	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	87
A2R58	RC07GF203J	RESISTOR 20K 5% 1/4W	81349	5-10083	88
					89
					90
A2VR1	LM309K	REGULATOR 5V	27014	3-60007	91
					92
					93
					94
					95
A2XZ24	CA-14S-TSD	I.C. SOCKET 14 PIN	52072	2-30056	96
A2XZ25	CA-14S-TSD	I.C. SOCKET 14 PIN	52072	2-30056	97
A2XZ42	CA-14S-TSD	I.C. SOCKET 14 PIN	52072	2-30056	98
					99
					100
					101
					102

MODEL DMM50	CALICO P/N 200435	ASSY R.D. A2
TITLE OPTION 07 and 08 BCD/PROG ASSY	SHT 7 OF 9	

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A2Z1	MCT2	ISOLATOR	0000I	2-50145	103
A2Z2	MCT2	ISOLATOR	0000I	2-50145	104
A2Z3	MCT2	ISOLATOR	0000I	2-50145	105
A2Z4	MCT2	ISOLATOR	0000I	2-50145	106
A2Z5	MCT2	ISOLATOR	0000I	2-50145	107
A2Z6	MCT2	ISOLATOR	0000I	2-50145	108
A2Z7	MCT2	ISOLATOR	0000I	2-50145	109
A2Z8	MCT2	ISOLATOR	0000I	2-50145	110
A2Z9	MCT2	ISOLATOR	0000I	2-50145	111
A2Z10	MCT2	ISOLATOR	0000I	2-50145	112
A2Z11	MCT2	ISOLATOR	0000I	2-50145	113
A2Z12	MCT2	ISOLATOR	0000I	2-50145	114
A2Z13	MCT2	ISOLATOR	0000I	2-50145	115
A2Z14	MCT2	ISOLATOR	0000I	2-50145	116
A2Z15	MCT2	ISOLATOR	0000I	2-50145	117
A2Z16	MCT2	ISOLATOR	0000I	2-50145	118
A2Z17	MCT2	ISOLATOR	0000I	2-50145	119
A2Z18	MCT2	ISOLATOR	0000I	2-50145	120
A2Z19	MCT2	ISOLATOR	0000I	2-50145	121
A2Z20	MCT2	ISOLATOR	0000I	2-50145	122
A2Z21	MCT2	ISOLATOR	0000I	2-50145	123
A2Z22	MCT2	ISOLATOR	0000I	2-50145	124
A2Z23	MCT2	ISOLATOR	0000I	2-50145	125
A2Z24	SN7405N	INVERTER	01295	3-60017	126
A2Z25	SN7403N	GATE, QUAD	01295	3-60018	127
A2Z26	MC1808P	GATE, QUAD	04713	3-60080	128
A2Z27	MC1808P	GATE, QUAD	04713	3-60080	129
A2Z28	MC1808P	GATE, QUAD	04713	3-60080	130
A2Z29	MC1808P	GATE, QUAD	04713	3-60080	131
A2Z30	MC1808P	GATE, QUAD	04713	3-60080	132
A2Z31	MC1808P	GATE, QUAD	04713	3-60080	133
A2Z32	MC1808P	GATE, QUAD	04713	3-60080	134
A2Z33	SN7490N	DECADE DRIVER	01295	3-60005	135
A2Z34	SN7490N	DECADE DRIVER	01295	3-60005	136
A2Z35	SN7490N	DECADE DRIVER	01295	3-60005	137
A2Z36	SN7490N	DECADE DRIVER	01295	3-60005	138

MODEL DMM50 | CALICO P/N 200435 | ASSY R.D. A2

TITLE OPTION 07 and 08 BCD/PROG ASSY | SHT 8 OF 9

CALIFORNIA INSTRUMENTS CO. SAN DIEGO, CALIFORNIA	CODE IDENT 16067	PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A2Z37	SN74192N	DEC. UP/DN CTR	01295	3-60014	139
A2Z38	SN7400N	QUAD GATE	01295	3-60000	140
A2Z39	SN7476N	FL-FL. DUAL J-K	01295	3-60070	141
A2Z40	SN7404N	INVERTER	01295	3-60002	142
A2Z41	SN7404N	INVERTER	01295	3-60002	143
A2Z42	MC1808P	GATE, QUAD	04713	3-60080	144
					145
					146
					147
					148
	6103B	HEAT SINK	13103	6-10527	149
	P253	MYLAR TAPE .75 WIDE	07080		150
	NW4-2813	WASHER, NYLON .03 THK	95987	2-10533	151
					152
	8160-N-0440	NYLON STANDOFF 7/8 LG	06540	2-10528	153
	N440-1/4 BINDER HD.	SCREW, NYLON 4-40	95987	2-10529	154
					155
					156
					157
					158
					159
	24 GA BLK	WIRE INS.			160
	24 GA RED	WIRE INS.			161
	24 GA WHT	WIRE INS.			162
	18 GA BLK	WIRE INS.			163
	18 GA RED	WIRE INS.			164
					165
					166
					167
					168
					169
					170
					171
					172
					173
					174

MODEL	CALICO P/N	ASSY R.D.
DMM50	200435	
TITLE	SHT	
OPTION 07 and 08 BCD/PROG ASSY	9 OF 9	A2

APPENDIX A

The following code numbers are from the Federal Supply Code for Manufacturers Cataloging Handbook H4-1 and its latest supplement. Alphabetical codes have been arbitrarily assigned to suppliers not appearing in the H4 Handbook.

0000A	ElectriCord	Westfield, PA
0000B	Tech. Prod. Sales	Sorrento Valley, CA
0000C	Jackson Bros.	Waduon, Surrey, England
0000D	Chicago Std. Transformer Co.	Chicago, IL
0000E	Use Code #08289	
0000F	Colvern	Santa Monica, CA
0000G	Use Code #30983	
0000H	Mial of Italy c/o Q.C. Components	Los Angeles, CA
0000I	Use Code #50522	
0000J	Use Code #34333	
0000K	Elma	Schweiz, Germany
0000L	Use Code #32293	
0000M	Use Code #16950	
0000N	Use Code #15912	
0000R	American Handle	Philadelphia, PA
0000S	OPCDA	Edison, NJ
0000T	Use Code #31743	
0000U	Use Code #32293	
0000V	Falmat	Los Angeles, CA
0000W	Milton Ross Co.	Southampton, PA
0000X	Use Code #52072	
0000Y	Use Code #29990	
00141	Pic Design Corp.	E. Rockaway, NY
00194	Walsco Electronics Corporation	Los Angeles, CA
00544	Metal-Cal Div., Avery Prod. Corp.	Inglewood, CA
00656	Aerovox Corporation	New Bedford, MA
00779	AMP, Inc.	Harrisburg, PA
00853	Sangamo Electric Company	Pickens, SC
00866	Gee Eng. Co., Inc.	City of Industry, CA
01121	Allen-Bradley Company	Milwaukee, WI
01179	Ajax Magnethermic Corp.	NE Warren, OH
01255	Litton Industries, Inc.	Beverly Hills, CA
01281	T R W Semiconductors, Inc.	Lawndale, CA
01295	Texas Instruments, Inc.	Dallas, TX
02111	Spectrol Electronics	City of Industry, CA
02114	Ferroxcube Corp.	Saugerties, NY
02335	Fairchild Controls Corp.	Hicksville, LI, NY
02660	Amphenol Corporation	Broadview, IL
02799	Use Code #72136	
03507	General Electric Company	Syracuse, NY
03508	General Electric Company	Syracuse, NY
03516	General Electric Company	Somersworth, NH
03797	Eldema Corporation	Compton, CA
03888	Pyrofilm Resistor Co., Inc.	Cedar Knolls, NJ
03911	Clairex Corporation	New York, NY
04009	Arrow-Hart and Hegeman Elec. Co.	Hartford, CT
04062	Use Code #72136	
04713	Motorola Semiconductor Prod., Inc.	Phoenix, AZ
04963	3-M	St. Paul, MN
05236	Jonathan Mfg. Co.	Fullerton, CA
05276	Pomona Electronics Co., Inc.	Pomona, CA
05347	Ultronixs	Grand Junction, CO
05397	Kemet, Union Carbide Corp.	Cleveland, OH
05820	Wakefield Engineering, Inc.	Wakefield, MA
06046	Dixson Meter	Grand Junction, CO
06184	Conelco Components	San Bernadino, CA
06223	Kooltronic Fan Company	Princeton, NJ
06229	Electrovert, Incorporated	Mt. Vernon, NY
06383	Panduit Corp.	Tinley Park, IL
06514	Stantron, Wyco Metal Products	N. Hollywood, CA
06540	Amathom Elect. Hardward	New Rochelle, NY
06682	Magnetic Shield Div.	Chicago, IL
06776	Robinson, Nugent, Inc.	New Albany, IN
06915	Richco Plastics, Co.	Chicago, IL
07088	Kelvin Electric Company	Van Nuys, CA
07115	Use Code #14674	
07256	Silicon Transistor Corp.	Garden City, NY
07263	Fairchild Camera and Instr. Corp.	Mt. View, CA
07387	Birtcher Corporation	Los Angeles, CA
07556	Unitrack Calabro Plastics	Upper Darby, PA
07633	Epoxy Prod. Co. Div. of Allied Prod. Corp.	New Haven, CT
07713	Sperry Rand Corporation	Norwalk, CT
07716	I R C Incorporated	Burrington, IA
07910	Continental Devices	Hawthorne, CA
08065	Accurate Rubber and Plastics Co.	San Diego, CA
08261	Spectra Strip	Garden Grove, CA
08289	Blinn-Delbert Co., Inc.	Pomona, CA
08594	Eimac Div. of Varian Associates	Salt Lake, UT
08718	Use Code #71468	
08730	Vemaline Products Co.	Franklin Lakes, NJ
09026	Babcock Electronics Corp.	Costa Mesa, CA
09145	Atohm, Technical Industries, Inc.	Burbank, CA
09353	C and K Components, Inc.	Newton, MA
11432	Diamond Metal Sales	Gardena, CA
11815	Cherry Rivet Div., Townsend Co.	Santa Ana, CA
12020	Ovenaire, Incorporated	Charlottesville, VA
12143	Bendix Corporation	Santa Ana, CA
12405	Hysol Corporation	El Monte, CA
12406	Elpac, Incorporated	Fullerton, CA
12463	Omtronics Mfg., Incorporated	Omaha, NE
12673	Wesco Electrical Co.	Greenfield, MA
12697	Clarostat Mfg. Co., Incorporated	Dover, NH
13103	Thermalloy Company	Dallas, TX
13454	Texas Crystals	River Grove, IL
13571	Electronic Research	Overland Park, KS
13919	Burr-Brown Research Corp.	Tucson, AS
14099	Semtech Corporation	Newbury Park, CA
14193	Cal-R Inc.	Santa Monica, CA
14655	Cornell-Dubilier Elect. Corp.	Newark, NJ
14674	Corning Glass Works	Corning, NY
14726	Hollingsworth Co.	Phoenixville, PA
14752	Electro Cube, Incorporated	San Gabriel, CA
14907	Cramer Div. of Conrac	Old Saybrook, CT
15132	Electra Scientific Corporation	Fullerton, CA
15636	Elec-trol	Northridge, CA
15801	Fenwall Electronics	Framingham, MA
15818	Amelco, Teledyne, Incorporated	Mt. View, CA
15909	Use Code #17870	
15912	Ansley	Los Angeles, CA
16067	California Instruments Company	San Diego, CA
16758	Delco Radio Div., General Motors	Kokomo, IN
16795	Bristol Electronics Inc.	Bedford, MA
16902	Simpson Instruments, Inc.	Escondido, CA
16950	Precision Dynamics Corp.	Burbank, CA
17545	Angstrohm Precision, Inc.	Van Nuys, CA
17838	Mektron, California General, Inc.	Chula Vista, CA
17870	Daven Div., Thomas A. Edison	Manchester, NH
18076	Umpco	City of Industry, CA
18121	Wilshire Foam Products, Inc.	Gardena, CA
18178	Vactec Inc.	Maryland Heights, MO
18324	Signatics	Sunnyvale, CA
18612	Vishay Instruments Inc.	Malvern, PA
18677	Scambe Mfg. Co.	Monterey Park, CA
18702	Ducommun Metals and Supply Co.	Los Angeles, CA
18722	R C A	Mountaintop, PA
19080	The Robinson Company	Hawthorne, CA
19781	Potter Company	Sun Valley, CA
20857	South Bay Cable Corp.	Gardena, CA
21270	Behr-Manning	Watervliet, NY
21604	Buckeye Stamping Company	Columbus, OH
22045	Jordan Elect.	Van Nuys, CA
22599	Elastic Stop Nut Corporation	Van Nuys, CA
23039	Deccofelt Products Company	Glendora, CA
23050	Product Components Corp.	Hastings-on-Hudson, NY
23095	Antel Electronics Inc.	Anaheim, CA
23783	British Radio Electric Ltd.	Washington, DC
23936	Pamotor, Incorporated	San Francisco, CA
24011	E C C	Burlington, MA
24655	General Radio	Concord, MA
24796	Parelco Inc.	Paramount, CA
24931	Specialty Connector Co., Inc.	Indianapolis, IN
25403	Amperex (Diodes)	Slaterville, RI
25684	Victoreen Instrument Co., Inc.	Oak Lawn, IL
25706	Daburn Electronics and Cable Corp.	New York, NY
26528	Lamcor, Incorporated	Anaheim, CA
26533	Use Code #98376	
27014	National Semi-Conductor Corp.	Santa Clara, CA
27191	Cutler-Hammer, Inc.	Milwaukee, WI
27264	Molex	Downers Grove, IL
27556	IMB Electronic Products	Santa Fe Springs, CA
27683	Varo, Incorporated	St. Garland, TX
28480	Hewlett-Packard Co.	Palo Alto, CA
28520	Heyman Mfg. Company (Heyco)	Kenilworth, NJ
30086	I-T-E Circuit Breaker Co.	Philadelphia, PA
30817	Instrument Specialties Co.	Little Falls, NJ
30897	Dorann Co.	Sylmar, CA
30983	Electra/Midland (Mepco/Electra)	San Diego, CA
31743	Elpower	Santa Ana, CA
31951	Tridge Inc.	Pittsburgh, PA
32293	Intersil	Cupertino, CA
34333	Silicon General	Westminister, CA
35929	Constanta	Quebec, Canada
42190	Muter Company	Chicago, IL
44655	Ohmite Manufacturing Company	Skokie, IL
45722	Parker-Kalon	Clifton, NJ
46384	Penn. Eng. and Mfg. Corp.	Doylestown, PA
49956	Raytheon Co.	Lexington, MA
50522	Monsanto, Electronic Special Products	Cupertino, CA
51705	ICO/Rally	Palo Alto, CA
52072	Circuit Assembly Corp.	Costa Mesa, CA
53209	W. H. Brady Co.	Milwaukee, WI
56289	Sprague Electric Company	North Adams, MA
57771	Stimson	Bayport, NY
58474	Superior Electric Company	Bristol, CT
59730	Thomas and Betts Company	Elizabeth, NJ
60741	Triplett Electrical Instrument Co.	Bluffton, OH
63743	Ward Leonard Electric Co.	Mt. Vernon, NY
70318	Allmetal Screw Prod. Co.	Garden City, NY
70903	Belden Manufacturing Co.	Chicago, IL
71002	Birnbach Radio Company, Inc.	New York, NY
71218	Bud Radio	Willoughby, OH
71279	Cambridge Thermionic Corp.	Cambridge, MA
71400	Bussman Mfg. Div., McGraw-Edison Co.	St. Louis, MO
71450	CTS Corporation	Elkhart, IN
71468	ITT Cannon Electric, Inc.	Los Angeles, CA
71590	Centralab Div., Globe-Union, Inc.	Milwaukee, WI
71744	Chicago Miniature Lampworks	Chicago, IL
71785	Cinch Manufacturing Company	Chicago, IL
72136	Elmenco (Electro Motive)	Willimantic, CT
72259	Nytronics, Incorporated	Pelham Manor, NY
72619	Dialight Corporation	Brooklyn, NY
72699	General Instruments	Newark, NJ
72982	Erie Technological Products, Inc.	Erie, PA
73138	Beckman Instruments, Inc.	Fullerton, CA
73445	Amperex (Capacitors)	Long Island, NY
73559	Carling Electric, Inc.	West Hartford, CT
73734	Federal Screw Products, Inc.	Chicago, IL
73899	J F D Electronics Company	Brooklyn, NY
73949	Guardian Electric Mfg. Co.	Chicago, IL
73957	Groov-Pin Corporation	Ridgefield, NJ
74193	Heinemann Electric Company	Trenton, NJ
74276	Signalite, Incorporated	Neptune, NJ
74542	Hoyt Electrical Instrument Works	Penacook, NH
74545	Harvey Hubbel, Inc.	Bridgeport, CT
74970	E. F. Johnson Company	Waseca, MN
75382	Kulka Electric Corporation	Mt. Vernon, NY
75915	Littlefuse, Incorporated	Des Plaines, IL
75987	Use Code #95987	
76055	Mallory Controls	Frankfort, IN
76348	Miller Products Company	New York, NY
76385	Minor Rubber Co.	Bloomfield, NJ
76493	J. W. Miller Company	Los Angeles, CA
76854	Oak Manufacturing Company	Crystal Lake, IL
77342	Potter and Brumfield Div., Amer. Machine and Foundry Company	E. Princeton, IN
77638	General Instruments	Brooklyn, NY
77969	Rubber Craft Corp. of California	Torrance, CA
78189	Shakeproof Div., Illoms Tool Works	Chicago, IL
78299	Struthers-Dunn. Incorporated	Pitman, NJ
78488	Stackpole Carbon Company	St. Marys, PA
78526	Stanwyck Winding Company, Inc.	Newburgh, NY
78553	Tinnerman Products, Inc.	Cleveland, OH
78947	Ucinite Company	Newtonville, MA
79130	Johns-Manville Products Corp.	Chicago, IL
79727	Continental-Wirt Electronics Corp.	Warminister, PA
79963	Zierick Mfg. Corporation	New Rochelle, NY
80031	Mepco/Electra	Morristown, NJ
80112	G. C. Electronics Company	Los Angeles, CA
80223	United Transformer Co.	New York, NY
80294	Bourns, Incorporated	Riverside, CA
80368	Sylvania Electric Products, Inc.	New York, NY
80583	Hammarlund Mfg. Co.	Red Bank, NJ
81073	Grayhill, Incorporated	La Grange, IL
81095	Triad Transformer Corp.	Venice, CA
81312	Winchester Electronics	Oakville, CT
81349	Military Spec., Standardization Division Directorate of Logistic Services DSA	
82104	Standard Grigsby	Aurora, IL
82389	Switchcraft, Incorporated	Chicago, IL
82877	Rotron Manufacturing Co., Inc.	Woodstock, NY
82893	Vector Electronics Inc.	Sylmar, CA
83058	Car Fastener Company	Cambridge, MA
83125	Nytronics Inc. Cap. Division	Darlington, SC
83324	Rosan, Incorporated	Newport Beach, CA
83330	Herman H. Smith, Inc.	Brooklyn, NY
83594	Burroughs Corporation	Plainfield, NJ
83701	Electronic Devices, Incorporated	Yonkers, NY
83827	Resistors Inc.	Chicago, IL
84171	Arco Electronics, Inc.	Great Neck, NY
86684	R C A	Harrison, NJ
86928	Seastrom Mfg. Co.	Glendale, CA
87034	Marco-Oak Industries	Anaheim, CA
88026	Use Code #27191	
88245	Useco Div., Litton Industries	Van Nuys, CA
90201	Mallory Capacitor Company	Indianapolis, IN
91459	Alcon Metal Prod. Inc.	Chicago, IL
91506	Augat	Attlebord, MA
91637	Dale Electronics, Inc.	Columbus, NE
91662	Elco Corporation	Willow Grove, PA
91812	Janco Corporation	Burbank, CA
91833	Keystone Electronics Corp.	New York, NY
91929	Micro Switch Div., Honeywell, Inc.	Freeport, IL
92194	Alpha Wire Corporation	Elizabeth, NJ
92219	Waldom Electronics, Inc.	Chicago, IL
93332	Sylvania Electric Products, Inc.	Woburn, MA
94222	Southco, Incorporated	Lester, PA
95146	Alco Electronics Products	Lawrence, MA
95303	R C A	Cincinnati, OH
95416	Use Code #95146	
95987	Weckesser Company, Inc.	Chicago, IL
96682	Genisco, Incorporated	Compton, CA
96733	San Fernando Electric Mfg. Co.	San Fernando, CA
97525	Electronic Engineering Co.	Santa Ana, CA
97918	Linemaster Switch Corp.	Woodstock, CT
97954	U.S. Components, Incorporated	Bronx, NY
98159	Rubber Teck, Incorporated	Gardena, CA
98278	Microdot, Incorporated (Lerco)	S. Pasadena, CA
98291	Sealectro Corp.	Mamaroneck, NY
98376	Zero Mfg. Co. (West)	Burbank, CA
98978	IERC	Burbank, CA
99028	Globe	Gardena, CA
99378	Atlee Corp.	Woburn, MA
99392	STM Corporation	Oakland, CA
99515	Marshall Industries	Monrovia, CA
99517	Vacco Industries	El Monte, CA
99742	Permacel Div., Johnson and Johnson	New Brunswick, NJ
99743	I M C	Maywood, CA
99800	Delevan Electronics Corporation	Aurora, NY
*29990	American Technical Ceramics	Huntington Station, NY

ONE YEAR WARRANTY

CALIFORNIA INSTRUMENTS COMPANY a division of AIKEN INDUSTRIES INC. warrants each instrument manufactured by them to be free from defects in material and workmanship for a period of one year from the date of shipment to the original purchaser. Excepted from this warranty are tubes, fuses, and batteries which carry the warranty of their original manufacturer where applicable. CALIFORNIA INSTRUMENTS COMPANY will service, replace, or adjust any defective part or parts, free of charge, when the instrument is returned to the Company freight prepaid, and when examination reveals that the fault has not occurred because of misuse or abnormal conditions of operation. Equipment repaired beyond the effective date of warranty or when abnormal usage has occurred will be charged at applicable rates. CALIFORNIA INSTRUMENTS COMPANY will submit an estimate for such charges before commencing repair if so requested.

PROCEDURE FOR SERVICE

If a fault develops, notify CALIFORNIA INSTRUMENTS COMPANY or its local representative, giving full details of the difficulty, and including the model number and serial number. On receipt of this information, service data or shipping instructions will be furnished. If shipment is indicated, forward the instrument, freight prepaid, to the authorized repair station indicated in the instruction. If requested, an estimate of the charges will be made before the work begins, provided the instrument is not covered by the warranty.

DAMAGE IN TRANSIT

The instrument should be tested as soon as it is received. If it fails to operate properly, or is damaged in any way, a claim should be filed with the carrier. A full report of the damage should be obtained by the claim agent, and this report should be forwarded to us. CALIFORNIA INSTRUMENTS COMPANY will advise the disposition to be made of the equipment and arrange for repair or replacement. Please include model number and serial number when referring to the instrument.

MP MASTER
MA28084